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NATIONAL DAM SAFETY PROGRAM. BARBER DAM (MO 20570), MISSOURI - --ETC(U)
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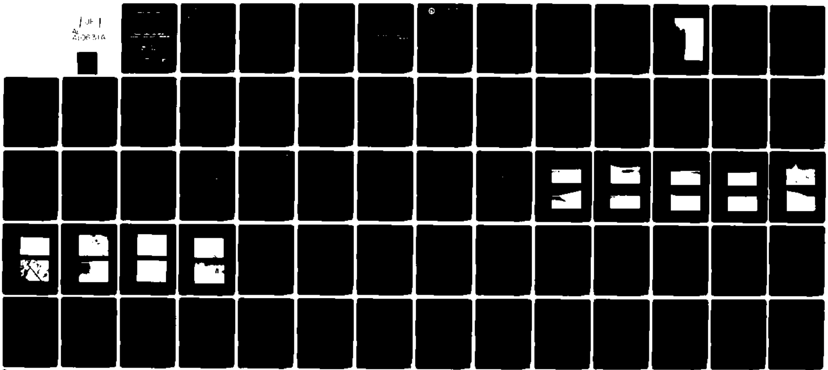

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MISSOURI-KANSAS CITY BASIN

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BARBER DAM
JACKSON COUNTY, MISSOURI
MO 20570

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
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St. Louis District

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PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

DECEMBER 1980

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MISSOURI-KANSAS CITY BASIN

BARBER DAM
JACKSON COUNTY, MISSOURI
MO 20570

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
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St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT. ST. LOUIS

FOR: STATE OF MISSOURI

DECEMBER 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO
ATTENTION OF

SUBECT: Barber Dam, Mo. ID No. 20570

Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Barber Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED — 9 APR 1981

Chief, Engineering Division — Date

APPROVED BY: SIGNED — 10 APR 1981

Colonel, CE, District Engineer — Date

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BARBER DAM

JACKSON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 20570

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

UNDER DIRECTION OF

ST. LOUIS DISTRICT CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

DECEMBER 1980

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Barber Dam
State Located	Missouri
County Located	Jackson County
Stream	Tributary of Lake Lotawana
Date of Inspection	16 December 1980

Barber Dam was inspected by a team of engineers from Black & Veatch, Consulting Engineers for the St. Louis District, Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and state agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a intermediate size dam with a high downstream hazard potential. According to the St. Louis District, Corps of Engineers, failure would threaten lives and property. The estimated damage zone extends approximately two miles downstream of the dam. Within the estimated damage zone are more than ten dwellings, one highway, Lake Lotawana (Mo. Id. 20040), and one building. Contents of the estimated downstream damage zone were verified by the inspection team.

Our inspection and evaluation indicates the drop inlet spillway and two overflow sections do not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway and overflow sections will not pass the probable maximum flood without overtopping but the dam will pass 65 percent of the probable maximum flood. The spillway and overflow sections will pass the flood which has a one percent chance of occurrence in any given year (100-year flood). The spillway design flood recommended by the guidelines is 100 percent of the probable maximum flood. The probable maximum flood is defined as the flood discharge which may be expected from the most severe combination of critical meteorologic and hydrologic conditions which are reasonably possible in the region.

Based on visual observations, this dam appears to be in satisfactory condition. Deficiencies visually observed by the inspection team were erosion of the upstream slope, erosion at the waterline due to wave action, embankment cracking along the upstream edge of the crest, possible settlement of the crest in proximity of the original stream channel, animal burrows in the embankment, no grass cover slope protection on upstream face, and no riprap protection. Seepage and stability analyses required by the guidelines were not available.

There were no observed deficiencies or conditions existing at the time of the inspection which indicated an immediate safety hazard. Future corrective action and regular maintenance will be required to correct or control the described deficiencies. In addition, detailed seepage and stability analyses of the existing dam, as required by the guidelines, should be performed. A detailed report discussing each of these deficiencies is attached.

Edwin R. Burton

Edwin R. Burton, PE
Missouri E-10137

Harry L. Callahan

Harry L. Callahan, Partner
Black & Veatch

OVERVIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
BARBER DAM

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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above the District Engineer of the St. Louis District, Corps of Engineers, directed that a safety inspection of Barber Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

(1) The dam is an earth structure located in the valley of a tributary of Lake Lotawana (see Plate 1). The watershed is an area of low hills consisting of about 95 percent cropland and 5 percent residental urban development. The dam is approximately 1,845 feet long along the crest and 49 feet high. The dam crest is [illegible] feet wide. The downstream face of the dam has a relatively uniform slope from the crest to the valley floor below.

(2) The spillway is a 4-foot diameter welded steel pipe drop inlet with an antivortex plate and trash bars, and with a 3-foot diameter welded steel outlet pipe. The spillway drop inlet is located approximately 40 feet upstream from the crest of the dam. The flow through the spillway will be controlled by the water surface elevation above the spillway crest. A trash rack is attached to the inlet opening crest and the top of the antivortex plate. The spillway pipe protrudes about 4 feet vertically from the embankment fill. Discharges from the spillway pipe are to a cultivated valley downstream of the dam.

(3) Located at both ends of the dam embankment are defined overflow sections. From inspection these sections appear to be formed as a result of not extending the dam crest elevation entirely to the natural valley walls. See Plate 5.

(4) Pertinent physical data are given in paragraph 1.3.

b. Location. The dam is located in southeast Jackson County, Missouri, as indicated on Plate 1. The lake formed by the dam is in an area shown on the United States Geological Survey 7.5 minute series quadrangle map for Lake Jacomo, Missouri in Section 1 of T47N, R31W, and Section 6 of T47N, R30W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, the dam and impoundment are in the intermediate size category. An intermediate size dam is classified as having a height less than 100 feet, but greater than or equal to 40 feet and/or a storage capacity less than 50,000 acre-feet, but greater than or equal to 1,000 acre-feet.

d. Hazard Classification. The hazard classification assigned by the Corps of Engineers for this dam is as follows: Barber Dam has a high hazard potential, meaning that the dam is located where failure may cause loss of life, and serious damage to homes, agricultural, industrial and commercial facilities, and to important public utilities, main highways, or railroads. For Barber Dam the estimated flood damage zone extends approximately two miles downstream of the dam. Within the estimated damage zone are more than ten dwellings, one highway, Lake Lotawana (Mo Id 20040), and one building. Contents of the estimated downstream damage zone were verified by the inspection team.

e. Ownership. The dam is owned by Mr. Anthony Barber, Milton-Thompson Road, Lee's Summit, Mo.

f. Purpose of Dam. The dam will form a 146-acre lake used for recreation and potential future irrigation.

g. Design and Construction History. Data relating to the design and construction were not available. Mr. Barber, however, stated that construction took 2 years and was completed in 1978.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration, evaporation, and overflow through the uncontrolled spillway is expected to maintain a relatively stable water surface elevation. The reservoir pool has not filled to the spillway elevation since closure of the dam.

1.3 PERTINENT DATA

a. Drainage Area - 818 acres

b. Discharge at Damsite.

(1) Normal discharge at the damsite is designed to pass through the 4-foot diameter drop inlet and 3-foot diameter discharge pipe.

(2) Estimated experienced maximum flood at damsite - Unknown. The site did, however, experience a rainfall of about 10.5 inches during a 24 hour period in September 1977. The dam was under construction at that time and flood water was released through two 10-inch drain pipes.

(3) Estimated ungated spillway capacity at maximum pool elevation 4,820 cfs (Probable Maximum Flood Pool El. 989.1).

c. Elevation (Approximate, feet above m.s.l. based on USGS spot elevation).

(1) Top of dam - 988.3 (see Plate 3)

(2) Spillway crest - 983.3

(3) Streambed at toe of dam - 939.0

(4) Maximum tailwater - Unknown.

d. Reservoir.

(1) Length of maximum pool - 4,300 feet ± (Probable maximum flood pool level)

(2) Length of normal pool - 3,800 feet ± (Spillway crest)

e. Storage (Acre-feet).

(1) Top of dam - 2,740

(2) Spillway crest - 1,910

(3) Reservoir pool at time of inspection (Elevation 966.0) - 443

(4) Design surcharge - Not available.

f. Reservoir Surface (Acres).

(1) Top of dam - 190

(2) Spillway crest - 146

(3) Reservoir pool at time of inspection (Elevation 966.0) - 47

g. Dam.

(1) Type - Earth embankment

(2) Length - 1,845 feet

(3) Height - 49 feet $\pm$

(4) Top width - 17 feet

(5) Side slopes - upstream face between 1.0 V on 3.1 H and 1.0 V on 3.5 H, downstream face between 1.0 V on 3.0 H and 1.0 V on 4.0 H (see Plate 4)

(6) Zoning - Unknown.

(7) Impervious core - Unknown.

(8) Cutoff - Unknown.

(9) Grout curtain - Unknown.

h. Diversion and Regulating Tunnel.

i. Spillway.

(1) Type - 4-foot diameter welded steel pipe drop inlet with 3-foot diameter welded steel outlet pipe, antivortex plate and trash rack.

(2) Drop inlet crest elevation - 983.3 feet m.s.l.

(3) Drop inlet invert elevation - 953.8 feet m.s.l.

(4) Outlet pipe invert elevation - 950.0 feet m.s.l.

(5) Gates - None.

(6) Upstream channel - None.

(7) Downstream channel - Discharges to cultivated valley below the dam.

j. <u>Overflow Sections</u>.

(1) Type - The areas between the dam crest and abutments are grass lined channels which will act as emergency spillways.

(2) East channel crest - 985.2 feet m.s.l.
West channel crest - 985.9 feet m.s.l.

(3) Gates - None.

(4) Upstream channel - Grasslined.

(5) Downstream channel - Discharge to downstream slope and abutments.

k. <u>Regulating Outlets</u> - Owner reported that two, 10-inch diameter pipes with valves are inplace as regulating devices. He further reported that these two pipes were used during the September 1977 flood. These pipes and valves were not found by the inspection team.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Design data were not available. Survey data, dated December 1979, including the drop inlet crest elevation and normal reservoir shoreline on land adjoining the owner's were provided by Harvey A. Jones Engineering Co., Inc.

2.2 CONSTRUCTION

Construction records were unavailable. The owner reported that the construction of the dam took 2 years and that fill material came from reservoir pool area. The dam was reportedly completed in 1978.

2.3 OPERATION

Operational records and documentation of floods since completion of the dam were unavailable. The dam was under construction during the September 1977 flood and the owner reported that two 10-inch diameter, valved pipes were used to release the flood pool stored during this particular flood event.

2.4 GEOLOGY

The site for the dam and reservoir is located across a broad shallow valley. The dam impounds the drainage from a tributary to Lake Lotawana.

The soils in the area of the dam and reservoir are of the Polo-Sogn soil association (1). The Polo soil series is developed in loess overlying interbedded shales and limestones and is composed of silty clay. The Sogn soil series is developed in residuum from weathering of limestones and is composed of clay. No engineering classifications of either the Polo or Sogn soil series were available.

The bedrock in the area of the dam and reservoir consists of interbedded shale and limestone of the Kansas City Group of the Des Moinesian series of the Pennsylvanian System. The depth to rock is not known (2).

2.5 EVALUATION

a. Availability. No engineering data were available.

b. Adequacy. No engineering data were available. Thus, an assessment of the design, construction, and operation could not be made. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity. The validity of the design, construction, and operation could not be determined due to the lack of engineering data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Barber Dam was made on 16 December 1980. The inspection team consisted of Edwin Burton, team leader; Robert Pinker, geologist; Gary Van Riessen, geotechnical engineer; Paul MacRoberts, civil engineer; and Thomas Rutherford hydraulic-hydrologic engineer. The dam appeared to be in satisfactory condition. Specific observations are discussed below. No observations were made of the condition of the upstream face of the dam below the pool elevation at the time of the inspection.

b. Dam. The inspection team observed the following conditions at the dam. An area of cracking along the upstream edge of the crest was observed from approximately station 13+00 to 14+00. The cracks were eroded to about 6 inches wide and were from 1 to 2 feet deep. Some minor sloughs along the edge of the crest in this area had occurred. There were numerous animal burrows in this area. Field survey measurements indicate possible settlement in the region of the old streambed. No instruments to measure the performance of the dam were located. No toe drains or relief wells were observed.

A ponding area was observed downstream of the dam near the toe of the embankment. This area is believed to be the result of poor drainage from the cultivated cropland.

The dam crest has a mowed grass/weed cover with some worn spots, due to vehicle traffic. Wave action erosion was observed on the upstream slope. There is no riprap protection on the upstream face of the embankment. The upstream slope has uncontrolled weed growth, whereas, the downstream slope has a good stand of fescue grass.

Some erosion gullies were observed on the upstream slope and numerous animal burrows are present on both slopes.

No evidence was found to indicate that the embankment had ever been overtopped, or that the reservoir pool has reached the spillway inlet elevation.

There was no evidence that a maintenance program was in effect but the owner stated that he plans to seed the dam in 1981.

c. Appurtenant Structures. The inspection team observed the following items pertaining to the appurtenant structures. The spillway consists of a 4-foot diameter welded steel pipe with an antivortex plate and trash rack, and a 3-foot diameter welded steel outlet pipe. The spillway appeared to be in good condition. It should be noted that an abnormally large spillway discharge would probably not damage the embankment due to the location of the point of discharge.

There was no development in the spillway discharge area which would suffer damage due to flow through the spillway.

d. Geology. The soils surrounding the dam and reservoir consist of silty clays that have formed in loess and residuum from shale bedrock. The soils were visually classified for engineering purpose as silty clay of both low and high plasticity (CL or CH).

The foundation of the dam is shale. The abutments are residual silty clay soil overlying shale with thin interbedded limestones. The shale is thin-bedded, gray, and weathers to a tan. These thin limestone beds outcrop approximately 10 feet above the waterline.

The limestones are less than 0.5 feet thick, are not jointed, and are seprated by one to three feet of shale.

Auger samples of the material were taken with an Oakfield sampler near the center of the downstream crest of the embankment. The samples were visually classified as silty clay (CL). Based on these samples, it is surmised that the embankment is constructed of materials similar to those in the samples.

e. Reservoir Area. No slumping or slides of the reservoir banks were observed. Exposed valley walls in proximity to the embankment have been stripped of earth materials during dam construction. The upstream channel to the lake is relatively free of debris and trees. The lake was noted to be clean with no siltation.

f. Downstream Channel. The spillway discharges to the cultivated valley below the dam.

3.2 EVALUATION

The various deficiencies observed at the time of inspection have occurred during a period when the reservoir pool is filling. Deficiencies generally associated with full pool conditions or age of the structure such as seepage, tree growth, overtopping etc. were not noted. The observed deficiencies, herein reported, are not believed to represent an immediate safety hazard. They do, however, warrant monitoring and control. In addition to monitoring known deficiencies, the dam should be monitored during the filling process for seepage, piping along the outlet pipe and slope stability problems.

The low area surveyed on the dam crest at about station 11+00 appears to be in proximity of the original stream channel and could possibly be indicative of embankment material consolidation or consolidation of the underlying foundation materials. This is not believed to be a significant problem at this time, however, the dam crest should be monitored on a regular basis and if further lowering of the crest is observed it should be evaluated by an engineer experienced in earth structures.

The growth of weeds on the upstream slope, if allowed to go unchecked, could cause deterioration of the embankment. The weeds have effectively killed the smaller grasses whose roots are more effective in protecting the surface soil of the slope from erosion. The tall uncut weeds provides habitat for burrowing animals which can damage the embankment.

The area of ponding downstream of the dam which was observed should be monitored regularly to confirm that it is a not a dam related problem.

The erosion gullies on the upstream slope of the embankment will continue to erode unless they are repaired and seeded. The area of cracking and sloughing appeared to be due to a steepened upper slope which had been undercut by burrowing animals. The cracks have been widened and deepened by erosion due to surface drainage. This area should be redressed and seeded and monitored for any signs of slope instability.

The absence of riprap on the upstream slope of the dam has resulted in wave action erosion. If not corrected wave action will continue to erode the embankment and could lead to slope stability problems. Riprap protection should be placed around the protruding drop inlet structure as well as along the dam's upstream slope at the normal pool elevation. Observed erosion damage should be repaired prior to inundation by the reservoir pool.

Burrowing animals will continue to damage the embankment if a program is not undertaken to eliminate them. Piping failure of embankments have resulted from damages caused by burrowing animals.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The pool is primarily controlled by rainfall, runoff, evaporation, transpiration, and capacity of the uncontrolled spillway. Two valved 10-inch drain pipes are reportedly inplace for drawdown or irrigation use. The inspection team did not confirm their presence.

The relatively large storage volume at the designed normal pool elevation and small contributing watershed may lead to long periods of less than full reservoir conditions. A preliminary estimate, based solely on average annual precipitation and evaporation with no allowances for bank storage, seepage, etc., indicates that the reservoir filling process will take about 5 years. Abnormally wet or dry conditions will materially effect this estimated time period.

4.2 MAINTENANCE OF DAM

There was no evidence that a maintenance program was in effect.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no existing warning system or preplanned scheme for alerting downstream residents for this dam.

4.5 EVALUATION

A maintenance program should be developed and implemented to include planting and mowing grass cover on the embankment in order to reduce erosion and discourage animal burrowing.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were available.

b. Experience Data. The drainage area and lake surface area are developed from USGS Lake Jacomo Quadrangle Map. The dam layout is from a survey made during the inspection.

c. Visual Observations.

(1) The spillway appears to be in good condition. The lake level at the time of the inspection (El. 966.0) was below the spillway crest level by about 17 feet. There were no obstructions to flow in the downstream channel.

(2) The overflow sections at the abutments of the dam will act as emergency spillways during periods of flooding.

(3) Spillway discharges from the outlet pipe will not endanger the integrity of the dam.

(4) Discharges from the two overflow sections could cause erosion to occur on the downstream slopes in proximity to the abutments. There exists the possibility under extreme conditions that discharge could take place over the east basin divide to the adjacent valley in the vicinity of the overflow section.

d. Overtopping Potential. The combined capacity of the drop inlet spillway and the two overflow sections will not pass the probable maximum flood without overtopping the dam. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The spillway and overflow sections will pass 65 percent of the probable maximum flood without overtopping the dam. The spillway and overflow sections will pass the one percent chance flood estimated to have a peak inflow of 1,860 cfs resulting in an outflow of 72 cfs developed from a 24-hour, one percent chance rainfall. According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, a high hazard dam of intermediate size should pass 100 percent of the probable maximum flood. The portion of the estimated peak discharge of the probable maximum flood overtopping the dam would be 834 cfs of the total discharge from the reservoir of 5,820 cfs. The estimated duration of overtopping is 2.7 hours with a maximum height of 0.8 feet. The embankment could be jeopardized should overtopping occur for this period of time.

According to the St. Louis District, Corps of Engineers, the effect from rupture of the dam could extend approximately two miles downstream of the dam. More than ten dwellings, one highway, one building and Lake Lotawana (Mo. Id. 20040) could be severely damaged and lives could be lost should failure of the dam occur. Contents of the estimated downstream damage zone were verified by the inspection team. There does not appear to be any flood plain regulations or other constraints in force to limit future downstream development upstream of Lake Lotawana. The flood plain area downstream of Lake Lotawana has been studied under the Flood Insurance program and does have flood plain regulations in effect.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of conditions which affect the structural stability of this dam are discussed in Section 3, paragraph 3.1b.

b. Design and Construction Data. No design data relating to the structural stability of the dam were found. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Operating Records. No operational records exist.

d. Postconstruction Changes. No postconstruction changes are evident.

e. Seismic Stability. The dam is located in Seismic Zone 1 which is a zone of minor seismic risk. A properly designed and constructed earth dam using sound engineering principles and conservatism should pose no serious stability problems during earthquakes in this zone. The seismic stability of an earth dam is dependent upon a number of factors: embankment and foundation material classifications and shear strengths; abutment materials, conditions, and strengths; embankment zoning; and embankment geometry. Adequate descriptions of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment were not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the stability analysis required by the guidelines.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Several conditions observed during the visual inspection by the inspection team should be monitored, controlled and/or corrected. These are erosion on the upstream slope, erosion at the waterline due to wave action, the lack of adequate slope protection on the upstream slope of the embankment, possible settlement of the crest in proximity to the original stream channel, cracking along the upstream edge of the crest, ponding of water downstream of the dam, and animal burrows in the embankment. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

b. Adequacy of Information. Due to the absence of engineering design data, the conclusions in this report were based on performance history discussions with the owner and visual conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency. It is the opinion of the inspection team that a program should be developed as soon as possible to implement remedial measures recommended in paragraph 7.2b. If the safety deficiencies listed in paragraph 7.1a are not corrected, they will continue to deteriorate and lead to a serious potential of failure.

d. Necessity for Phase II. The Phase I investigation does not raise any serious questions relating to the safety of the dam nor does it identify any serious dangers which would require a Phase II investigation. However, the additional analyses noted in paragraph 2.5b are necessary for compliance with the guidelines.

e. Seismic Stability. This dam is located in Seismic Zone 1. Adequate description of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment were not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the recommended stability analysis.

7.2 REMEDIAL MEASURES

a. Alternatives. The spillway capacity would need to be increased or the lake level would need to be permanently maintained at a lower normal level to increase available flood storage in order to pass the spillway design flood without overtopping the dam.

b. Operation and Maintenance Procedures. The following operation and maintenance procedures are recommended and should be carried out under the direction of a professional engineer experienced in the design, construction, and maintenance of earth dams.

(1) Riprap should be placed on the upstream face of the dam to an elevation above the stabilized lake level to prevent erosion of the embankment material.

(2) The ponding area downstream of the embankment noted during the visual inspection should be closely monitored and documented to confirm that it is not dam related. Any significant findings contrary to the inspection teams conclusions should be evaluated.

(3) The upstream face of the dam should be redressed and seeded to develop a suitable protective cover.

(4) Wave induced erosion and/or sloughing should be repaired as the reservoir level increases during filling.

(5) An improved maintenance program should be developed to include control of weed growth on the embankment and periodic cutting of the grass on the embankment slopes.

(6) The animal burrows in the embankment should be corrected since they can contribute to the occurrence of piping. Control measures should be implemented to discourage animal activity in the area. The embankment slope should be monitored by a qualified engineer during repair of the embankment.

(7) Seepage and stability analyses should be performed.

(8) The observed settlement of the dam crest should be monitored on a regular basis to ascertain whether or not it is an ongoing condition. If the condition is found to be continuing, corrective measures should be developed by an engineer experienced in earth dams and implemented.

(9) A detailed inspection of the dam should be made periodically. More frequent inspections may be required if additional deficiencies are observed or the severity of the reported deficiencies increase.

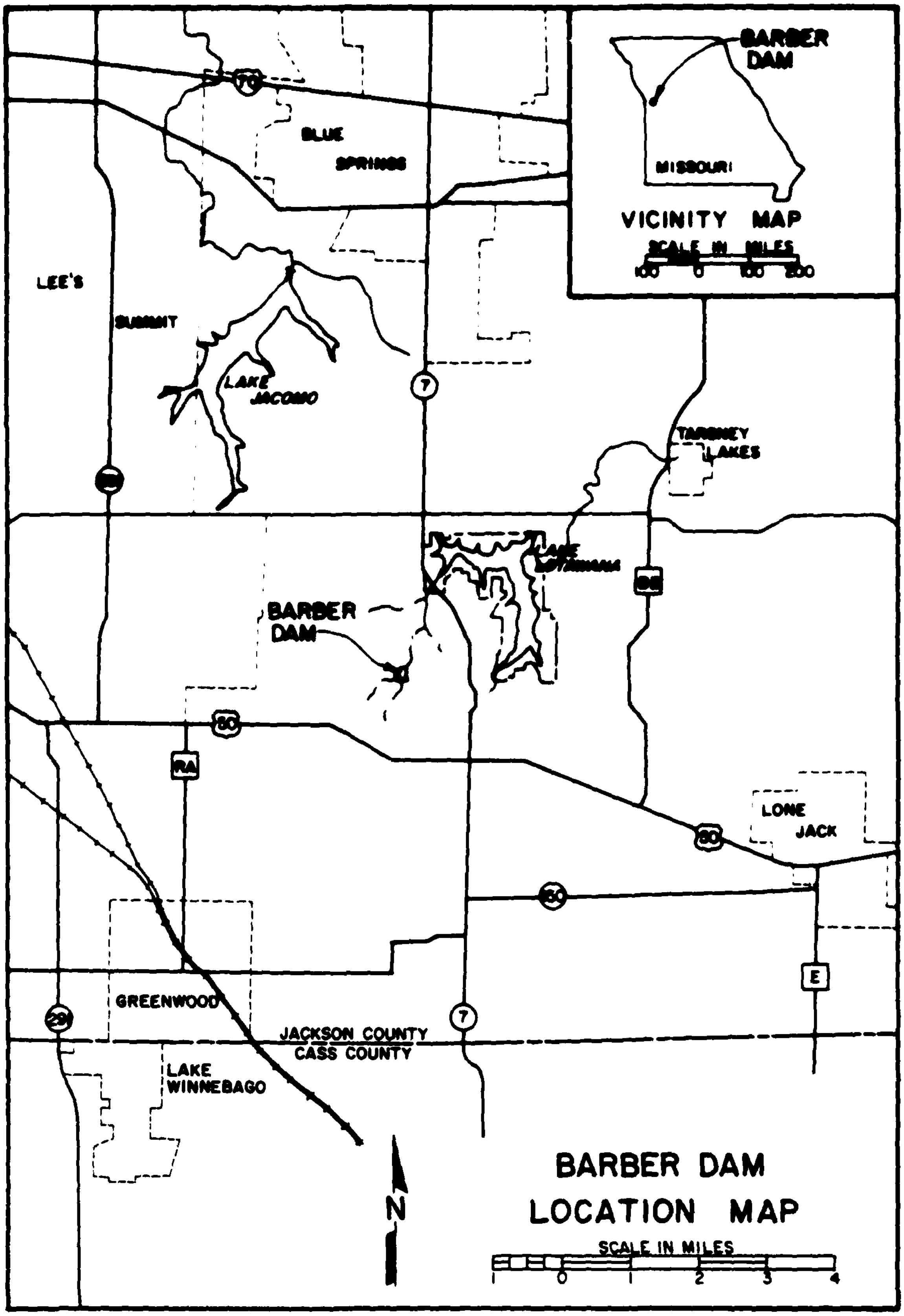
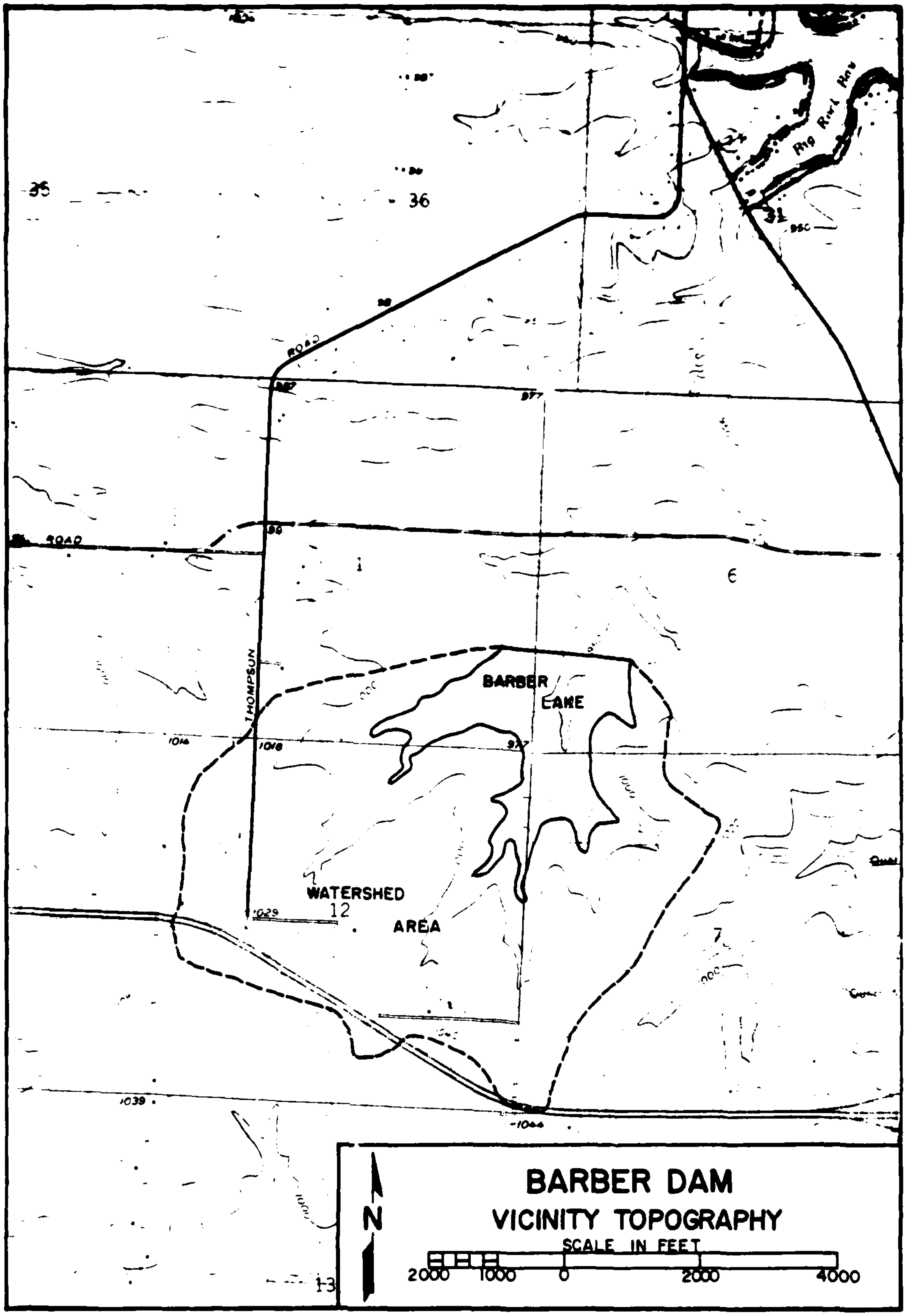

BARBER DAM
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
70
BLUE SPRINGS
LEE'S SUMMIT
LAKE JACOMO
7
LAKES
BARBER DAM
50
RA
LONE JACK
50
E
GREENWOOD
291
7
JACKSON COUNTY
CASS COUNTY
LAKE WINNEBAGO
N
BARBER DAM
LOCATION MAP
SCALE IN MILES
1 0 1 2 3 4

PLATE I



BARBER DAM
VICINITY TOPOGRAPHY
SCALE IN FEET
2000 1000 0 2000 4000
N
BARBER
LAKE
WATERSHED
AREA
THOMPSON
ROAD
36
1
6
12
7
13

PLATE 2

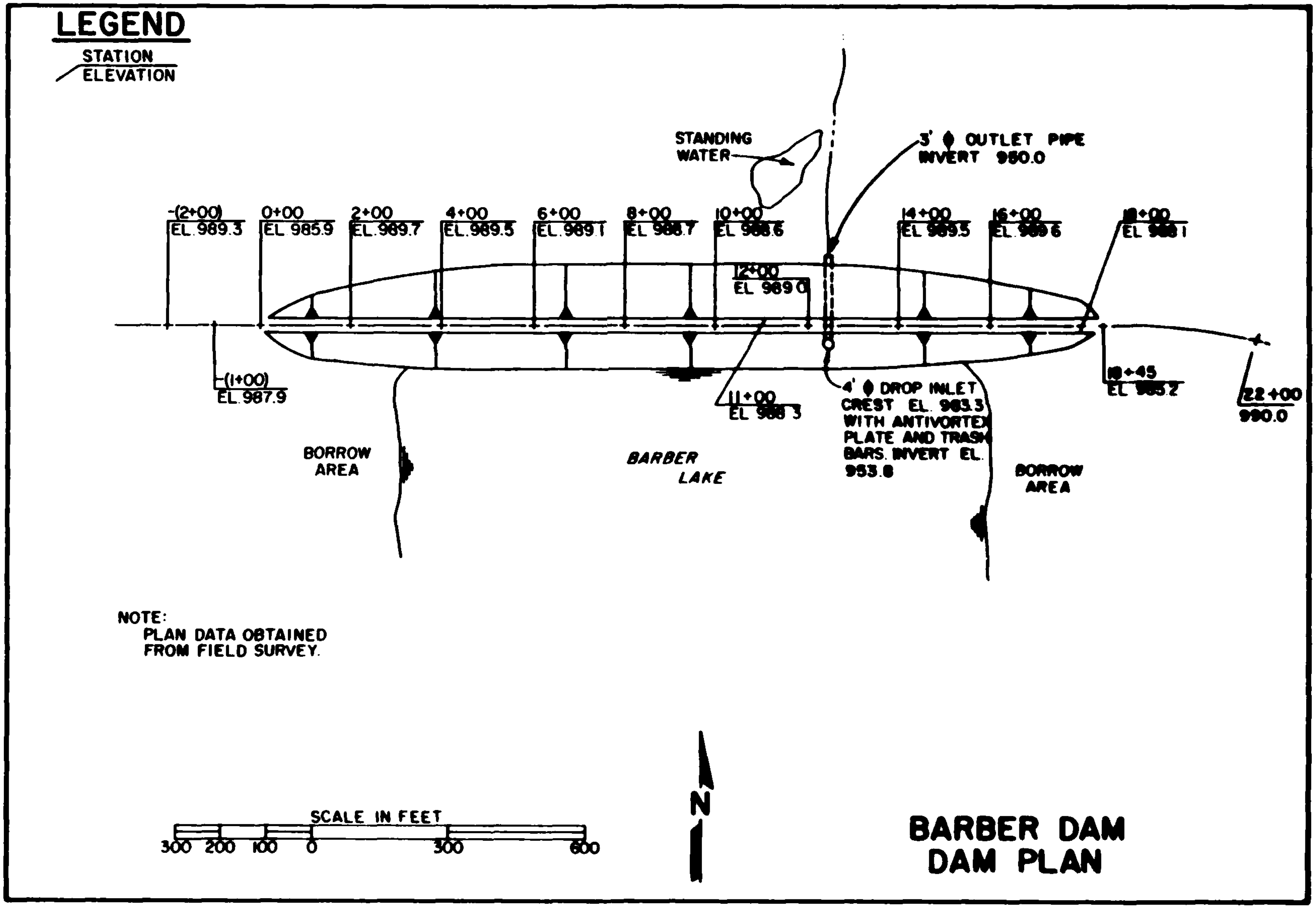
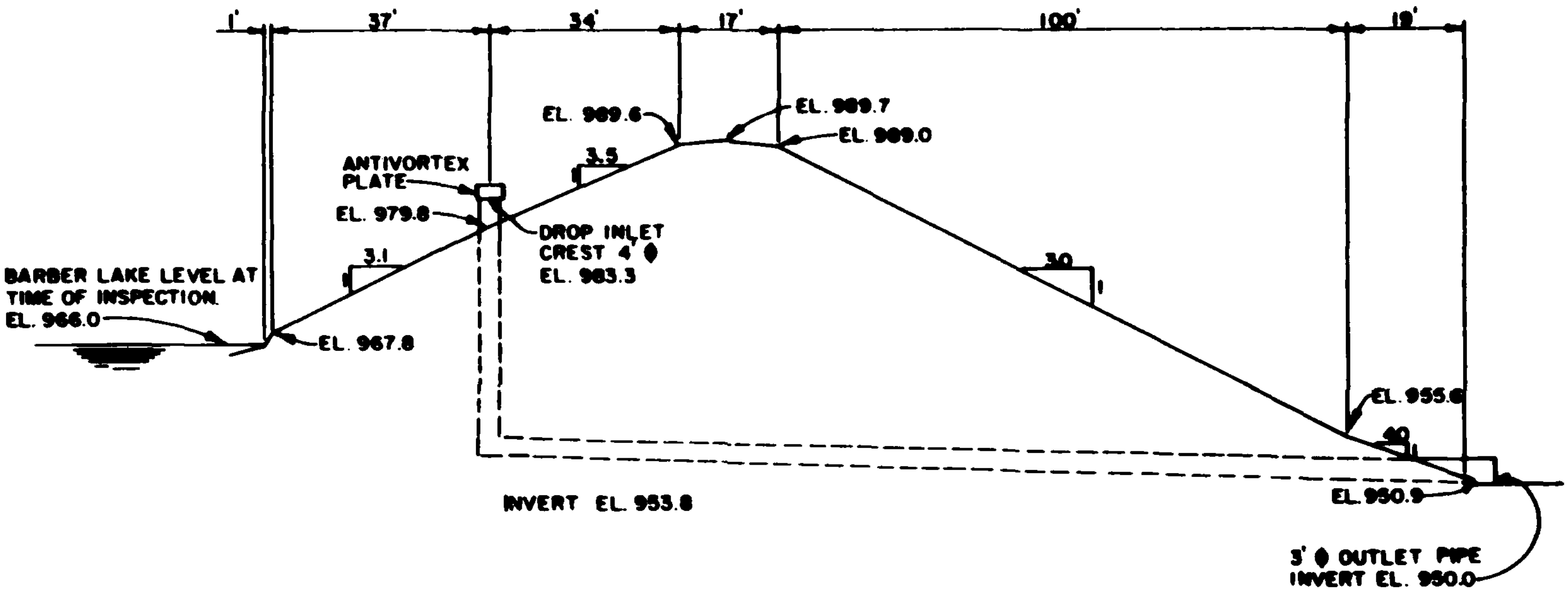

LEGEND
STATION
ELEVATION
STANDING WATER
3' ⌀ OUTLET PIPE INVERT 950.0
-(2+00) EL. 989.3
0+00 EL. 985.9
2+00 EL. 989.7
4+00 EL. 989.5
6+00 EL. 989.1
8+00 EL. 988.7
10+00 EL. 988.6
12+00 EL. 989.0
14+00 EL. 989.5
16+00 EL. 989.6
18+00 EL. 988.1
-(1+00) EL. 987.9
11+00 EL. 988.3
4' ⌀ DROP INLET CREST EL. 963.3 WITH ANTIVORTEX PLATE AND TRASH BARS. INVERT EL. 953.8
18+45 EL. 985.2
22+00 990.0
BORROW AREA
BARBER LAKE
BORROW AREA
NOTE:
PLAN DATA OBTAINED FROM FIELD SURVEY.
SCALE IN FEET
300 200 100 0 300 600
N
BARBER DAM
DAM PLAN

PLATE 3

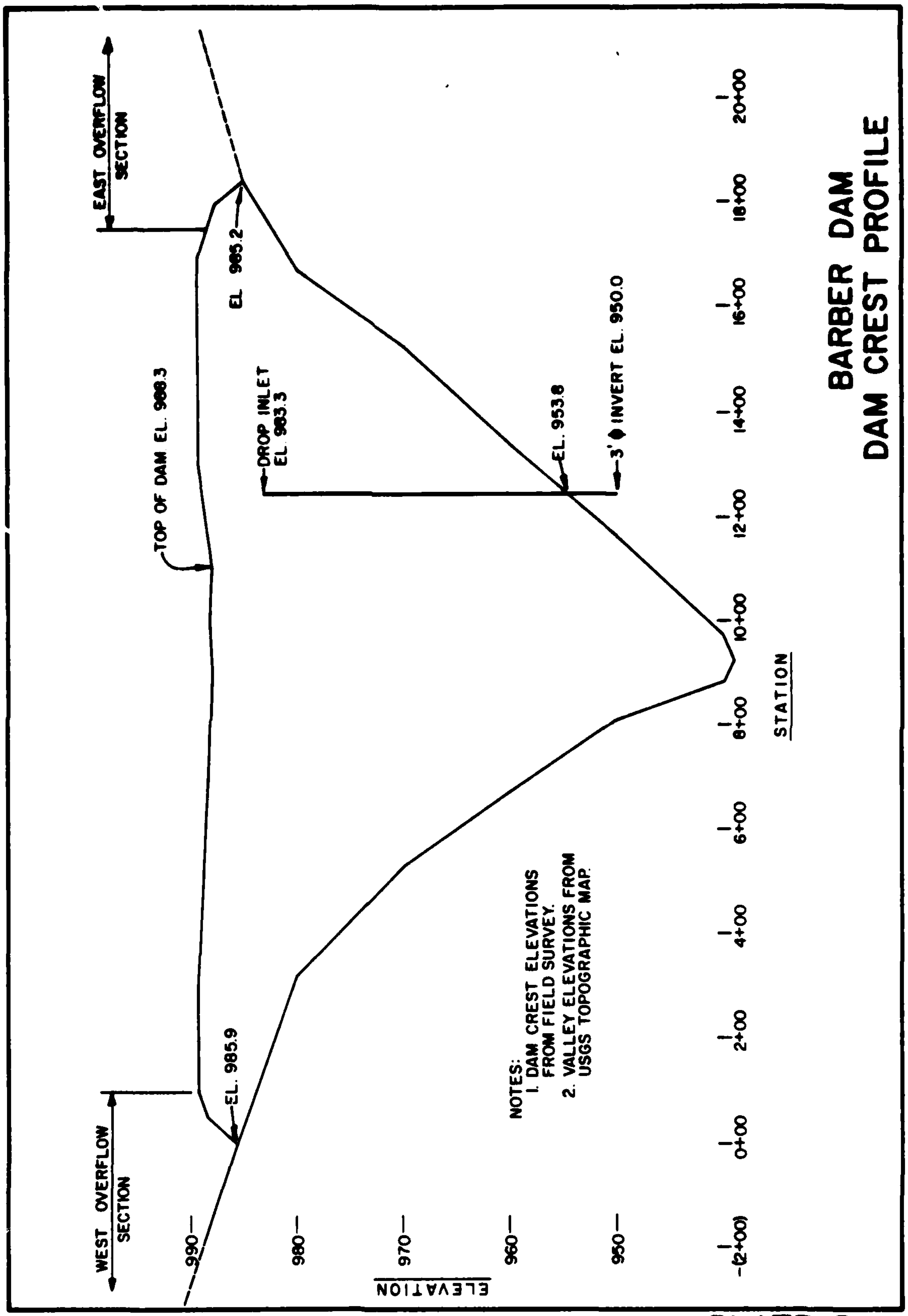


NOTE:
CROSS SECTION TAKEN AT STATION 12+45.

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1" = 20'

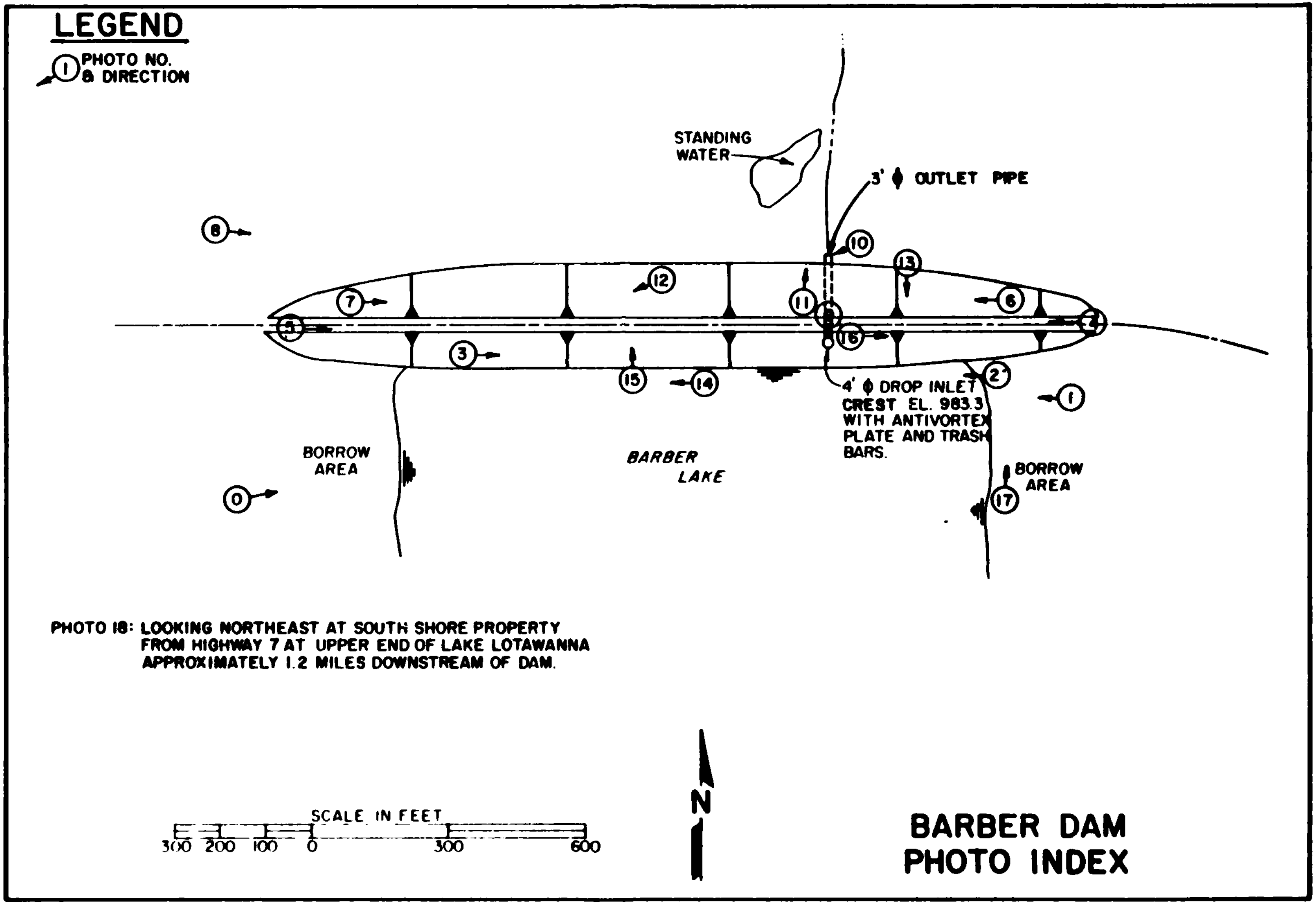
BARBER DAM
DAM CROSS SECTION

PLATE 4



BARBER DAM
DAM CREST PROFILE
WEST OVERFLOW SECTION
EAST OVERFLOW SECTION
TOP OF DAM EL. 988.3
EL. 985.9
EL. 985.2
DROP INLET EL. 983.3
EL. 953.8
3' ϕ INVERT EL. 950.0
NOTES:
1. DAM CREST ELEVATIONS FROM FIELD SURVEY.
2. VALLEY ELEVATIONS FROM USGS TOPOGRAPHIC MAP.
ELEVATION
990
980
970
960
950
STATION
(2+00)
0+00
2+00
4+00
6+00
8+00
10+00
12+00
14+00
16+00
18+00
20+00

PLATE 5



BARBER DAM PHOTO INDEX

PLATE 6

PHOTO 1: UPSTREAM FACE OF DAM LOOKING WEST

PHOTO : UPSTREAM FACE OF DAM AT WATERLINE LOOKING WEST

PHOTO 3: UPSTREAM FACE OF DAM LOOKING EAST

PHOTO 4: CREST OF DAM LOOKING WEST

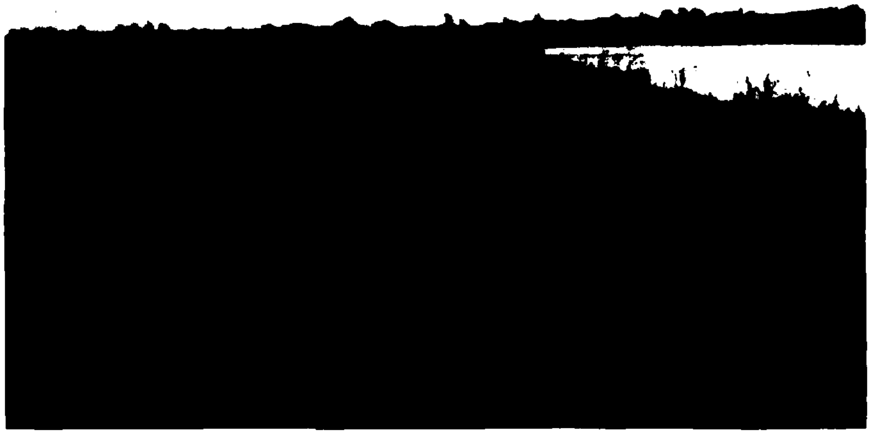


PHOTO 5: CREST OF DAM LOOKING EAST

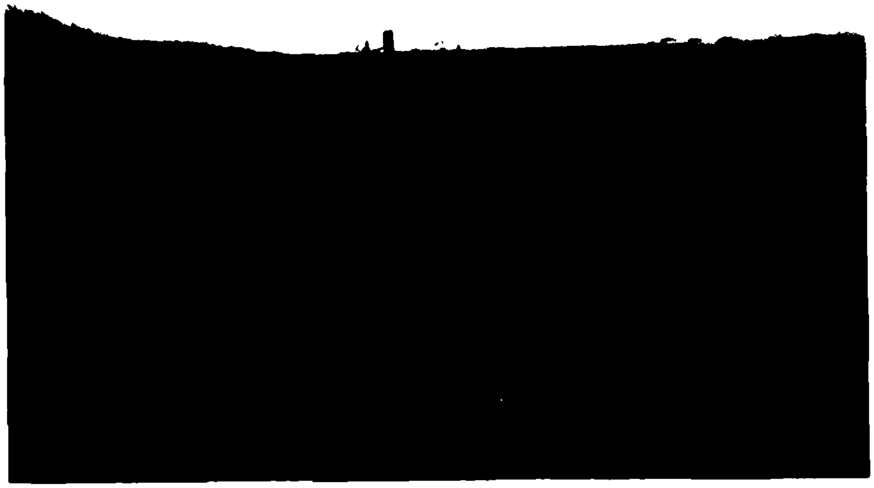


PHOTO 6: DOWNSTREAM FACE OF DAM LOOKING WEST

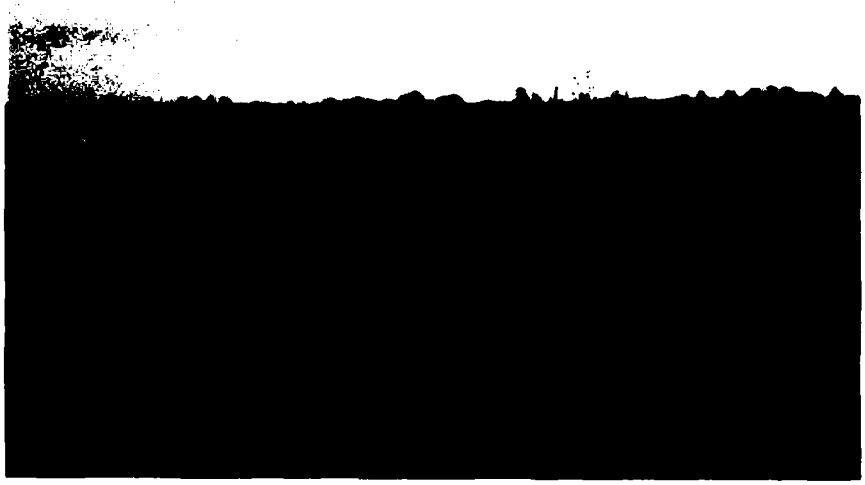
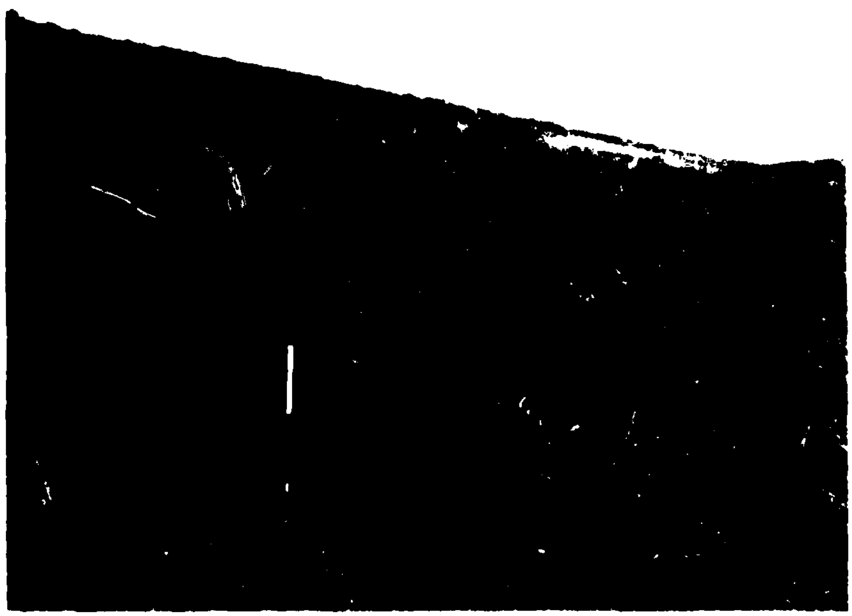


PHOTO 7: DOWNSTREAM FACE OF DAM LOOKING EAST

PHOTO 8: OVERVIEW OF DOWNSTREAM FACE OF DAM

[illegible] DROP INLET



[illegible] PIPE OUTLET

PHOTO 11: VALLEY DOWNSTREAM OF SPILLWAY OUTLET

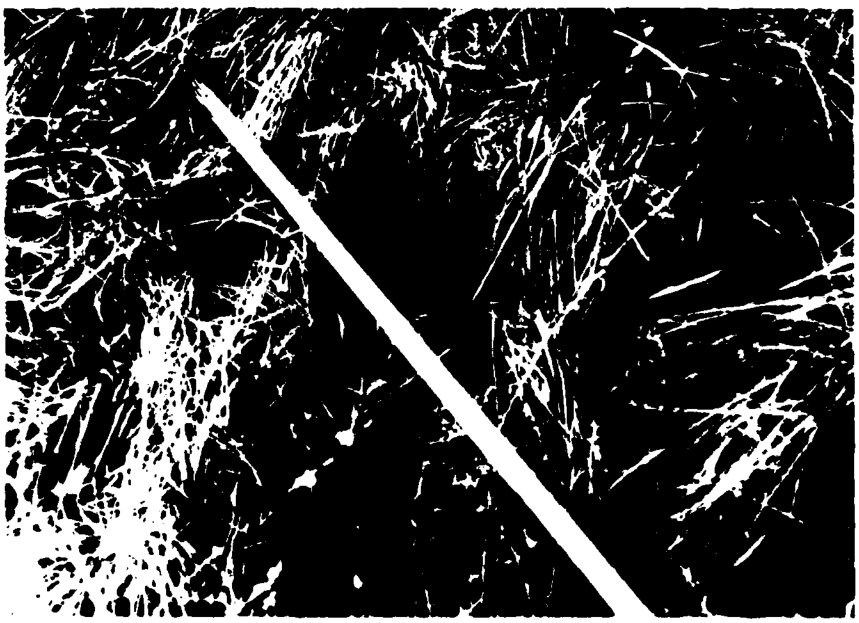


PHOTO 12: ANIMAL BURROW ON DOWNSTREAM FACE OF DAM

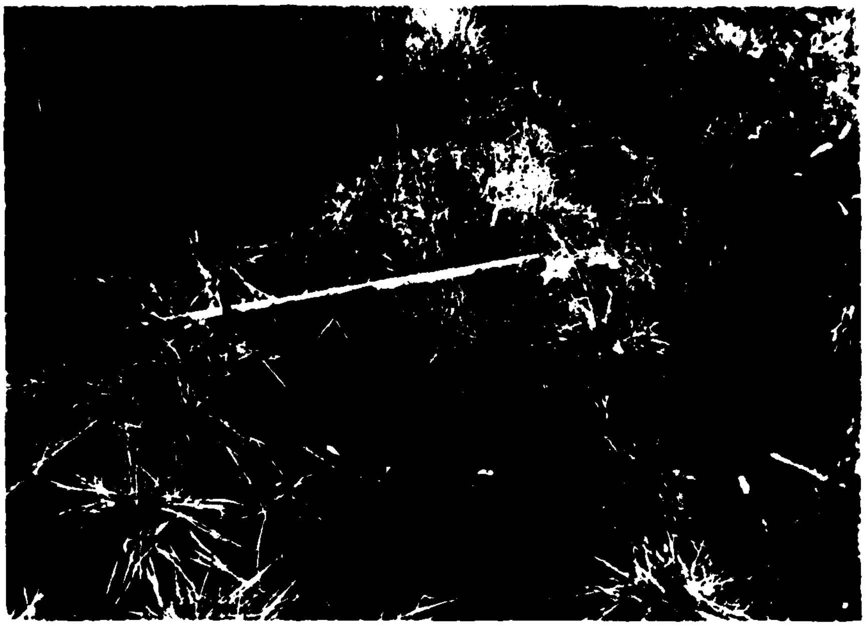


PHOTO 13: EROSION ON DOWNSTREAM FACE OF DAM

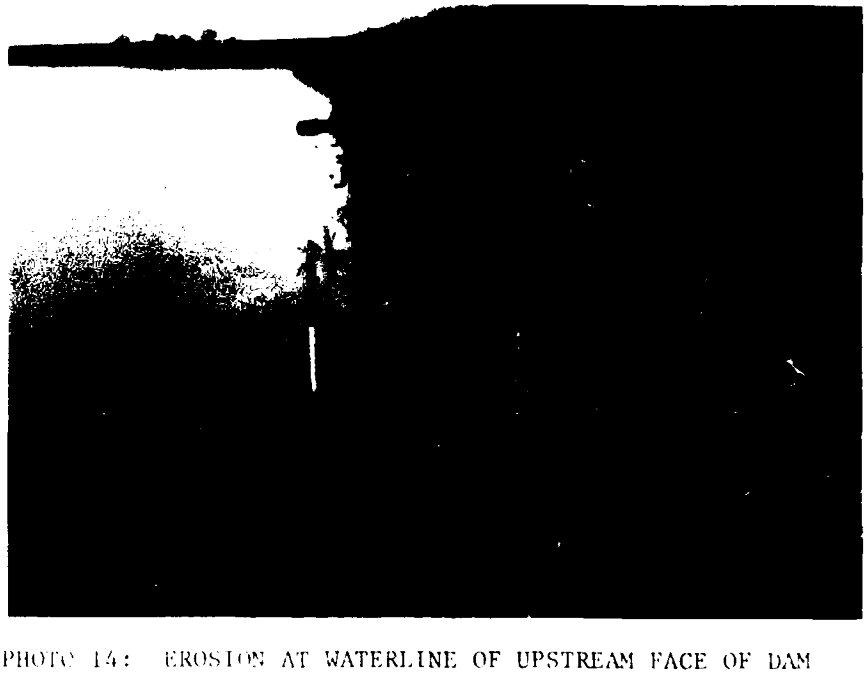


PHOTO 14: EROSION AT WATERLINE OF UPSTREAM FACE OF DAM

PHOTO 15: EROSION ON UPSTREAM FACE OF DAM

PHOTO 16: CRACK AT UPSTREAM EDGE OF CREST

PHOTO [illegible]: [illegible]STONE AND SHALE IN LAKE [illegible] OF DAM

PHOTO 13: [illegible]FRONT DEVELOPMENT AT UPPER LAKE [illegible] OF [illegible] DAM

APPENDIX A

HYDROLOGIC AND HYDRAULIC ANALYSES

HYDROLOGIC AND HYDRAULIC ANALYSES

To determine the overtopping potential, flood routings were performed by applying the Probable Maximum Precipitation (PMP) to a synthetic unit hydrograph to develop the inflow hydrograph. The inflow hydrograph was then routed through the reservoir, drop inlet spillway and two overflow sections. The overtopping analysis was determined using the computer program HEC-1 (Dam Safety Version) (3).

The PMP was determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33" (HMR-33) (4). Reduction factors were not applied. The rainfall distribution for the 24-hour PMP storm was determined according to the procedures outlined in HMR-33 and EM 1110-2-1411 (5). The Kansas City, Missouri rainfall distribution (5 min. interval - 24 hours duration), as provided by the St. Louis District, Corps of Engineers, was used when the one percent chance probability flood was routed through the reservoir, spillway and overflow sections.

The synthetic unit hydrograph for the watershed was developed by the computer program using the Soil Conservation Service (SCS) method (3, 8). The hydrograph lag time was calculated by the SCS Curve Number Method. This value was verified for reasonableness by the Kirpick formula. The parameters for the unit hydrograph are shown in Table 1.

The SCS curve number (CN) method was used in computing the infiltration losses for the rainfall-runoff relationship. The CN values used, and the result from the computer output, are shown in Table 2.

The reservoir routing was performed using the modified Puls method. The initial reservoir pool elevation for the routing of each storm was assumed to be equivalent to the crest elevation of the drop inlet spillway (983.3 feet m.s.l.) in accordance with antecedent storm conditions AMC II and AMC III preceding the one percent probability and probable maximum storms as outlined by the U.S. Army Corps of Engineers, St. Louis District (6). The hydraulic capacities of the drop inlet spillway and the two overflow sections, the surface area, and reservoir storage volume are defined by elevations as shown in Table 3.

The rating curve for the drop inlet spillway is shown in Table 4. The discharge rating curve for this spillway was calculated assuming the inlet was acting as a sharp-crested circular weir. The flow over the crest of the dam and through the two overflow sections was determined using the non-level dam crest option ($L and $V cards) of the HEC-1 program. The program assumes critical flow over a broad-crested weir.

The result of the routing analysis indicates that the drop inlet and the overflow sections will pass a flood equivalent to 65 percent of the PMF without overtopping the dam.

A summary of the routing analysis for different ratios of the PMF is shown in Table 5.

The computer input data and a summary of the output data are presented at the back of this appendix.

TABLE 1

SYNTHETIC UNIT HYDROGRAPH

Parameters:

Drainage Area (A)	818 acres	
Hydraulic Length of Watercourse (L)	4,200 feet	
Hydrologic Soil Cover Complex Number (CN')	92 (AMC III)	81 (AMC II)
Average Watershed Land Slope (Y)	1.4%	
Lag Time (L_g)	0.61 hours (AMC III)	0.89 hours (AMC II)
Time of concentration (T_c)	1.02 hours (AMC III)	1.48 hours (AMC II)
Duration (D)	4.9 min. (AMC III) (use 5 minutes in each case)	7.1 min. (AMC II)

Time (Min.) *	Discharge (cfs) * AMC III	AMC II
0	0	0
5	47	18
10	142	57
15	275	107
20	467	172
25	686	256
30	848	358
35	936	465
40	946	555
45	910	619
50	830	654
55	734	662

* From HEC-1 computer output

TABLE 1

(Continued)

Time (Min.) *	Discharge (cfs) * AMC III	AMC II
60	606	658
65	472	632
70	376	593
75	304	548
80	250	497
85	205	435
90	167	365
95	134	305
100	110	264
.	.	.
.	.	.
.	.	.
195	0	.
280	.	0

* From HEC-1 computer output

FORMULAS USED:

$$L_g = \frac{L^{0.8} \quad (S + 1)^{0.7}}{1,900 \quad Y^{0.5}} \qquad (7)$$

$$S = \frac{1000}{CN'} - 10$$

$$T_c = L_g/0.6$$

$$D = 0.133\ T_c$$

TABLE 2

RAINFALL-RUNOFF VALUES

Selected Storm Event	Storm Duration (Hours)	Rainfall (Inches)	Runoff (Inches)	Loss (Inches)
PMP	24	32.24	31.22	1.02
1% Probability	24	7.59	5.36	2.23

Additional Data:

1) The Soil Associations in this watershed were:
   80 percent Polo-Sogn, hydrologic soil groups B and D.
   20 percent Sharpsburg-Higginsville, hydrologic soil groups B and C (1)
2) SCS Runoff Curve CN = 92 (AMC III) for the PMF.
3) SCS Runoff Curve CN = 81 (AMC II) for the one percent probability flood.

TABLE 3

ELEVATION, SURFACE AREA, STORAGE, AND DISCHARGE RELATIONSHIPS

Elevation (feet-MSL)	Lake Surface Area (acres)	Lake Storage (acre-ft)	Drop Inlet Spillway Discharge (cfs)	Overflow Sections Discharge (cfs)
*983.3	146	1,910	0	0
**985.2	161	2,280	69	0
***988.3	190	2,740	140	2,550
989.1	196	2,900	174	4,820

*Drop inlet spillway crest elevation
**East overflow section crest elevation
***Top of dam elevation

The relationships in Table 3 were developed from the Lake Jacomo, Missouri, 7.5 minute quadrangle map and the field measurements.

TABLE 4

SPILLWAY RATING CURVE

Reservoir Elevation (ft-msl)	Primary Spillway Discharge (cfs)
*983.3	0
983.8	17
984.0	27
984.5	51
985.0	65
985.5	76
986.0	85
987.0	99
988.0	128
**988.3	140
989.0	171
990.0	195
991.0	197
992.0	200
995.0	207

*Drop inlet Spillway Crest Elevation
**Top of Dam Elevation

METHOD USED:

Drop inlet spillway releases were based on flow over a sharp-crested circular weir:

$Q = C_o\ (2\,\pi R_s)\ H_o^{1.5}$ (C_o = 3.8 to 1.0 - varying with approach depths and types of flow, Rs = 2.0 feet = radius of the pipe in feet for the spillway, H_o is the head on the weir in feet) (8).

Overflow section releases were computed by HEC-1 from geometry data input on $L and $V cards. Discharge through these sections for the probable maximum flood and other ratios of the probable maximum flood was determined by the equations for flow over a non-level crest.

$$d_c = 2/3\ (H_m + 1/4\ \Delta Y)$$
$$A = 1/2\ T\ (2d_c - \Delta Y)$$
$$Q = (A^3 g/T)^{0.5}$$

METHOD USED: (Continued)

where:

d_c = critical depth (feet)
H_m = available specific energy which is taken to be the height of the water surface in the reservoir above the bottom of the section (feet)
ΔY = change in elevation across the section (feet)
A = flow area (sq. ft.)
T = top width (feet)
Q = flow (cfs)
g = 32.2 ft/sec^2 = acceleration due to gravity.

TABLE 5

RESULTS OF FLOOD ROUTINGS

Ratio of PMF	Peak Inflow (CFS)	Peak Lake Elevation (ft.-MSL)	Total Storage (AC.-FT.)	Peak Outflow (CFS)	Depth (ft.) Over Top of Dam	Duration (hrs.) Over Top of Dam
-	0	*983.3	1,910	0	-	-
0.50	4,110	987.7	2,620	1,470	0	0
0.65	5,340	988.2	2,730	2,540	0	0
1.00	8,210	989.1	2,900	5,820	0.8	2.7

* Drop inlet spillway crest elevation

BIBLIOGRAPHY

(1) Mausel, Paul W., Scrinner, C.L.; Baker, J.C., and Johannsen, C.J., Regional Soils Guide. Mid America Regional Council, 1976.

(2) McCracken, Mary H., Geologic Map of Missouri, Division of Geological Survey and Water Resources, State of Missouri, 1961.

(3) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1), Dam Safety Version, July 1978, April 1980 Modification, Davis,California.

(4) U.S. Department of the Army, Corps of Engineers, Seasonal Variation of the Probable Maximum Precipitation East of the 105th Medidian for Areas from 10 to 1000 Square Miles and Durations of 6, 12, 24, and 48 hours, Hydrometeorological Report No. 33, Reprinted October 1967, Washington, D.C.

(5) U.S. Department of the Army, Corps of Engineers, Standard Project Flood Determinations, Civil Engineer Bulletin No. 52-8, EM 1110-2-1411, Revised 1965, Washington, D.C.

(6) U.S. Army Corps of Engineers, St. Louis District, Hydrologic/ Hydraulic Standards, Phase I Safety Inspection of Non-Federal Dams, 22 August 1980.

(7) U.S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972.

(8) U.S. Department of Interior, Bureau of Reclamation, Design of Small Dams, 1974, Washington, D.C.

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FLOOD HYDROGRAPH PACKAGE - HEC-1                                        PROGRAM H21/92-1V  TIME  18:25:00   CASE 801

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION       JULY 1978
  LAST MODIFICATION   01 APR 80
**********************************
   1            A1      MISSOURI DAM INSPECTIONS      FILE - H219457#MDI.BARBER
   2            A2      BARBER DAM
   3            A3      PMF AND RATIOS
   4            B     288       0       5       0       0       0       0       0       0       0
   5            B1      5
   6            J       1       9       1
   7            J10.5   0.55    0.6     0.65    0.7     0.75    0.8     0.85    1.0
   8            K             HEAD                                      1
   9            K1      CALCULATE INFLOW HYDROGRAPH TO LAKE
  10            M       1       21.28                   1.
  11            P       24.8    101.    120.    130.
  12            T                                                 -1-92.
  13            W2      0.61
  14            X               1.
  15            K       1     DAM                                       1
  16            K1      ROUTE HYDROGRAPHS PAST DAM
  17            Y                               1       1
  18            Y1      1                                       -983.3          -1
  19            Y4983.3 983.8   984.0   984.5   985.0   985.5   986.0   987.0   988.0   988.3
  20            Y4989.0 990.0   991.0   992.0   995.0
  21            Y50.    17.     27.     51.     65.     76.     85.     99.     128.    140.
  22            Y5171.  195.    197.    200.    207.
  23            $A0.    0.5     7.2     26.4    60.7    117.5   204.5   320.8
  24            $E979.  940.    950.    960.    970.    980.    990.    1000.
  25            $$983.3
  26            $D988.3
  27            $L0.    65.     230.    380.    465.    1045.   1203.   2195.   2435.
  28            $V985.2 985.9   987.0   988.0   988.3   988.8   989.0   989.7   990.
  29            K       99
  30            A
  31            A
  32            A
  33            A
  34            A
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FLOOD HYDROGRAPH PACKAGE - HEC-1                                   PROGRAM H21/02-1V  TIME  18:25:00   CASE 001

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************

                    MISSOURI DAM INSPECTIONS      FILE - H219457*M01.BARBER
                    LAFUSER DAM
                    PMF AND RATIOS

                                   JOB SPECIFICATION
          NO      NHR     NMIN    IDAY     IHR     IMIN    METRC    IPLT     IPRT    NSTAN
         288       0        5       0        0       0        0       0        0        0
                                 JOPER     NWT    LROPT    TRACE
                                   5        0       0        0

                         MULTI-PLAN ANALYSES TO BE PERFORMED
                            NPLAN= 1 NRTIO= 9 LRTIO= 1
        RTIOS=     .50     .55     .60     .65     .70     .75     .80     .85    1.00

     **********     **********     **********     **********     **********

                           SUB-AREA RUNOFF COMPUTATION

          CALCULATE INFLOW HYDROGRAPH TO LAKE

                ISTAQ    ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                 HEAD      0       0       0        0       0       1       0       0

                                 HYDROGRAPH DATA
         IHYDG    IUHG    TAREA     SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
           1        2      1.28      .00    1.28    1.00    .000      0       0       0

                                   PRECIP DATA
               SPFE      PMS       R6      R12      R24      R48      R72      R96
                .00    24.80   101.00   120.00   130.00     .00      .00      .00

                                    LOSS DATA
      LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
        0       .00     .00    1.00     .00     .00    1.00   -1.00  -92.00     .00     .00

        CURVE NO =  -92.00  WETNESS =   -1.00  EFFECT CN =   92.00

                              UNIT HYDROGRAPH DATA
                            TC=    .00      LAG=    .61

                                  RECESSION DATA
                     STRTQ=      .00     QRCSN=      .00    RTIOR= 1.00

        UNIT HYDROGRAPH 39 END OF PERIOD ORDINATES, TC=     .00 HOURS, LAG=    .61  VOL= 1.00
      47.      142.      275.      467.      686.      848.      936.      946.      910.      830.
     734.      606.      472.      374.      304.      250.      205.      167.      134.      110.
      89.       72.       58.       47.       38.       31.       26.       21.       17.       14.
      11.        9.        8.        6.        5.        4.        3.        1.        0.
```

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	.00	.01	0.	1.01	12.05	145	.21	.21	.00	640.
1.01	.10	2	.01	.00	.01	0.	1.01	12.10	146	.21	.21	.00	661.
1.01	.15	3	.01	.00	.01	0.	1.01	12.15	147	.21	.21	.00	700.
1.01	.20	4	.01	.00	.01	0.	1.01	12.20	148	.21	.21	.00	766.
1.01	.25	5	.01	.00	.01	0.	1.01	12.25	149	.21	.21	.00	863.
1.01	.30	6	.01	.00	.01	0.	1.01	12.30	150	.21	.21	.00	983.
1.01	.35	7	.01	.00	.01	0.	1.01	12.35	151	.21	.21	.00	1115.
1.01	.40	8	.01	.00	.01	0.	1.01	12.40	152	.21	.21	.00	1250.
1.01	.45	9	.01	.00	.01	0.	1.01	12.45	153	.21	.21	.00	1379.
1.01	.50	10	.01	.00	.01	0.	1.01	12.50	154	.21	.21	.00	1497.
1.01	.55	11	.01	.00	.01	0.	1.01	12.55	155	.21	.21	.00	1601.
1.01	1.00	12	.01	.00	.01	0.	1.01	13.00	156	.21	.21	.00	1686.
1.01	1.05	13	.01	.00	.01	0.	1.01	13.05	157	.25	.25	.00	1757.
1.01	1.10	14	.01	.00	.01	0.	1.01	13.10	158	.25	.25	.00	1817.
1.01	1.15	15	.01	.00	.01	0.	1.01	13.15	159	.25	.25	.00	1873.
1.01	1.20	16	.01	.00	.01	0.	1.01	13.20	160	.25	.25	.00	1929.
1.01	1.25	17	.01	.00	.01	1.	1.01	13.25	161	.25	.25	.00	1987.
1.01	1.30	18	.01	.00	.01	1.	1.01	13.30	162	.25	.25	.00	2047.
1.01	1.35	19	.01	.00	.01	2.	1.01	13.35	163	.25	.25	.00	2106.
1.01	1.40	20	.01	.00	.01	4.	1.01	13.40	164	.25	.25	.00	2161.
1.01	1.45	21	.01	.00	.01	5.	1.01	13.45	165	.25	.25	.00	2213.
1.01	1.50	22	.01	.00	.01	7.	1.01	13.50	166	.25	.25	.00	2258.
1.01	1.55	23	.01	.00	.01	9.	1.01	13.55	167	.25	.25	.00	2298.
1.01	2.00	24	.01	.00	.01	12.	1.01	14.00	168	.25	.25	.00	2330.
1.01	2.05	25	.01	.00	.01	14.	1.01	14.05	169	.31	.31	.00	2359.
1.01	2.10	26	.01	.00	.01	17.	1.01	14.10	170	.31	.31	.00	2389.
1.01	2.15	27	.01	.00	.01	20.	1.01	14.15	171	.31	.31	.00	2423.
1.01	2.20	28	.01	.00	.01	23.	1.01	14.20	172	.31	.31	.00	2466.
1.01	2.25	29	.01	.00	.01	25.	1.01	14.25	173	.31	.31	.00	2521.
1.01	2.30	30	.01	.01	.01	28.	1.01	14.30	174	.31	.31	.00	2583.
1.01	2.35	31	.01	.01	.01	31.	1.01	14.35	175	.31	.31	.00	2649.
1.01	2.40	32	.01	.01	.01	34.	1.01	14.40	176	.31	.31	.00	2715.
1.01	2.45	33	.01	.01	.01	36.	1.01	14.45	177	.31	.31	.00	2777.
1.01	2.50	34	.01	.01	.01	39.	1.01	14.50	178	.31	.31	.00	2834.
1.01	2.55	35	.01	.01	.01	41.	1.01	14.55	179	.31	.31	.00	2883.
1.01	3.00	36	.01	.01	.01	43.	1.01	15.00	180	.31	.31	.00	2924.
1.01	3.05	37	.01	.01	.01	46.	1.01	15.05	181	.19	.19	.00	2950.
1.01	3.10	38	.01	.01	.01	48.	1.01	15.10	182	.38	.38	.00	2967.
1.01	3.15	39	.01	.01	.01	50.	1.01	15.15	183	.38	.38	.00	2981.
1.01	3.20	40	.01	.01	.01	52.	1.01	15.20	184	.57	.57	.00	3002.
1.01	3.25	41	.01	.01	.01	54.	1.01	15.25	185	.67	.66	.00	3052.
1.01	3.30	42	.01	.01	.01	56.	1.01	15.30	186	1.62	1.61	.00	3201.
1.01	3.35	43	.01	.01	.01	58.	1.01	15.35	187	2.67	2.66	.00	3556.
1.01	3.40	44	.01	.01	.01	60.	1.01	15.40	188	1.05	1.05	.00	4135.
1.01	3.45	45	.01	.01	.01	62.	1.01	15.45	189	.67	.67	.00	4919.
1.01	3.50	46	.01	.01	.01	64.	1.01	15.50	190	.57	.57	.00	5890.
1.01	3.55	47	.01	.01	.01	65.	1.01	15.55	191	.38	.38	.00	6873.
1.01	4.00	48	.01	.01	.01	67.	1.01	16.00	192	.38	.38	.00	7642.
1.01	4.05	49	.01	.01	.01	68.	1.01	16.05	193	.29	.29	.00	8093.
1.01	4.10	50	.01	.01	.01	70.	1.01	16.10	194	.29	.29	.00	8211.
1.01	4.15	51	.01	.01	.01	71.	1.01	16.15	195	.29	.29	.00	8052.
1.01	4.20	52	.01	.01	.01	73.	1.01	16.20	196	.29	.29	[illegible]	[illegible]

1.01	4.25	53	.01	.01	.01	74.	1.01	16.25	197	.29	.29	.00	7139.
1.01	4.30	54	.01	.01	.01	75.	1.01	16.30	198	.29	.29	.00	6493.
1.01	4.35	55	.01	.01	.00	77.	1.01	16.35	199	.29	.29	.00	5844.
1.01	4.40	56	.01	.01	.00	78.	1.01	16.40	200	.29	.29	.00	5299.
1.01	4.45	57	.01	.01	.00	79.	1.01	16.45	201	.29	.29	.00	4852.
1.01	4.50	58	.01	.01	.00	80.	1.01	16.50	202	.29	.29	.00	4490.
1.01	4.55	59	.01	.01	.00	82.	1.01	16.55	203	.29	.29	.00	4195.
1.01	5.00	60	.01	.01	.00	83.	1.01	17.00	204	.29	.29	.00	3949.
1.01	5.05	61	.01	.01	.00	84.	1.01	17.05	205	.23	.23	.00	3745.
1.01	5.10	62	.01	.01	.00	85.	1.01	17.10	206	.23	.23	.00	3577.
1.01	5.15	63	.01	.01	.00	86.	1.01	17.15	207	.23	.23	.00	3429.
1.01	5.20	64	.01	.01	.00	87.	1.01	17.20	208	.23	.23	.00	3292.
1.01	5.25	65	.01	.01	.00	88.	1.01	17.25	209	.23	.23	.00	3163.
1.01	5.30	66	.01	.01	.00	89.	1.01	17.30	210	.23	.23	.00	3039.
1.01	5.35	67	.01	.01	.00	89.	1.01	17.35	211	.23	.23	.00	2924.
1.01	5.40	68	.01	.01	.00	90.	1.01	17.40	212	.23	.23	.00	2820.
1.01	5.45	69	.01	.01	.00	91.	1.01	17.45	213	.23	.23	.00	2725.
1.01	5.50	70	.01	.01	.00	92.	1.01	17.50	214	.23	.23	.00	2643.
1.01	5.55	71	.01	.01	.00	93.	1.01	17.55	215	.23	.23	.00	2573.
1.01	6.00	72	.01	.01	.00	94.	1.01	18.00	216	.23	.23	.00	2515.
1.01	6.05	73	.07	.05	.02	96.	1.01	18.05	217	.02	.02	.00	2460.
1.01	6.10	74	.07	.05	.02	102.	1.01	18.10	218	.02	.02	.00	2394.
1.01	6.15	75	.07	.05	.01	114.	1.01	18.15	219	.02	.02	.00	2308.
1.01	6.20	76	.07	.05	.01	133.	1.01	18.20	220	.02	.02	.00	2185.
1.01	6.25	77	.07	.05	.01	161.	1.01	18.25	221	.02	.02	.00	2021.
1.01	6.30	78	.07	.05	.01	196.	1.01	18.30	222	.02	.02	.00	1825.
1.01	6.35	79	.07	.05	.01	236.	1.01	18.35	223	.02	.02	.00	1614.
1.01	6.40	80	.07	.06	.01	276.	1.01	18.40	224	.02	.02	.00	1403.
1.01	6.45	81	.07	.06	.01	316.	1.01	18.45	225	.02	.02	.00	1203.
1.01	6.50	82	.07	.06	.01	353.	1.01	18.50	226	.02	.02	.00	1023.
1.01	6.55	83	.07	.06	.01	387.	1.01	18.55	227	.02	.02	.00	865.
1.01	7.00	84	.07	.06	.01	416.	1.01	19.00	228	.02	.02	.00	735.
1.01	7.05	85	.07	.06	.01	441.	1.01	19.05	229	.02	.02	.00	633.
1.01	7.10	86	.07	.06	.01	461.	1.01	19.10	230	.02	.02	.00	553.
1.01	7.15	87	.07	.06	.01	479.	1.01	19.15	231	.02	.02	.00	488.
1.01	7.20	88	.07	.06	.01	495.	1.01	19.20	232	.02	.02	.00	434.
1.01	7.25	89	.07	.06	.01	506.	1.01	19.25	233	.02	.02	.00	390.
1.01	7.30	90	.07	.06	.01	520.	1.01	19.30	234	.02	.02	.00	355.
1.01	7.35	91	.07	.06	.01	530.	1.01	19.35	235	.02	.02	.00	326.
1.01	7.40	92	.07	.06	.01	539.	1.01	19.40	236	.02	.02	.00	302.
1.01	7.45	93	.07	.06	.01	547.	1.01	19.45	237	.02	.02	.00	283.
1.01	7.50	94	.07	.06	.01	554.	1.01	19.50	238	.02	.02	.00	268.
1.01	7.55	95	.07	.06	.00	561.	1.01	19.55	239	.02	.02	.00	255.
1.01	8.00	96	.07	.06	.00	566.	1.01	20.00	240	.02	.02	.00	245.
1.01	8.05	97	.07	.06	.00	571.	1.01	20.05	241	.02	.02	.00	237.
1.01	8.10	98	.07	.06	.00	576.	1.01	20.10	242	.02	.02	.00	231.
1.01	8.15	99	.07	.06	.00	580.	1.01	20.15	243	.02	.02	.00	225.
1.01	8.20	100	.07	.06	.00	584.	1.01	20.20	244	.02	.02	.00	221.
1.01	8.25	101	.07	.06	.00	587.	1.01	20.25	245	.02	.02	.00	217.
1.01	8.30	102	.07	.06	.00	590.	1.01	20.30	246	.02	.02	.00	215.
1.01	8.35	103	.07	.06	.00	593.	1.01	20.35	247	.02	.02	.00	212.
1.01	8.40	104	.07	.06	.00	596.	1.01	20.40	248	.02	.02	.00	210.
1.01	8.45	105	.07	.06	.00	598.	1.01	20.45	249	.02	.02	.00	209.
1.01	8.50	106	.07	.06	.00	600.	1.01	20.50	250	.02	.02	.00	207.
1.01	8.55	107	.07	.06	.00	603.	1.01	20.55	251	.02	.02	.00	206.
1.01	9.00	108	.07	.06	.00	605.	1.01	21.00	252	.02	.02	.00	205.

1.01	9.05	109	.07	.06	.00	606.	1.01	21.05	253	.02	.02	.00	205.
1.01	9.10	110	.07	.06	.00	608.	1.01	21.10	254	.02	.02	.00	205.
1.01	9.15	111	.07	.06	.00	609.	1.01	21.15	255	.02	.02	.00	205.
1.01	9.20	112	.07	.06	.00	611.	1.01	21.20	256	.02	.02	.00	205.
1.01	9.25	113	.07	.06	.00	612.	1.01	21.25	257	.02	.02	.00	205.
1.01	9.30	114	.07	.06	.00	614.	1.01	21.30	258	.02	.02	.00	205.
1.01	9.35	115	.07	.06	.00	615.	1.01	21.35	259	.02	.02	.00	205.
1.01	9.40	116	.07	.06	.00	616.	1.01	21.40	260	.02	.02	.00	205.
1.01	9.45	117	.07	.06	.00	617.	1.01	21.45	261	.02	.02	.00	205.
1.01	9.50	118	.07	.06	.00	618.	1.01	21.50	262	.02	.02	.00	205.
1.01	9.55	119	.07	.06	.00	619.	1.01	21.55	263	.02	.02	.00	205.
1.01	10.00	120	.07	.06	.00	620.	1.01	22.00	264	.02	.02	.00	205.
1.01	10.05	121	.07	.06	.00	621.	1.01	22.05	265	.02	.02	.00	205.
1.01	10.10	122	.07	.06	.00	622.	1.01	22.10	266	.02	.02	.00	205.
1.01	10.15	123	.07	.06	.00	622.	1.01	22.15	267	.02	.02	.00	205.
1.01	10.20	124	.07	.06	.00	623.	1.01	22.20	268	.02	.02	.00	205.
1.01	10.25	125	.07	.06	.00	624.	1.01	22.25	269	.02	.02	.00	205.
1.01	10.30	126	.07	.06	.00	625.	1.01	22.30	270	.02	.02	.00	205.
1.01	10.35	127	.07	.06	.00	625.	1.01	22.35	271	.02	.02	.00	205.
1.01	10.40	128	.07	.06	.00	626.	1.01	22.40	272	.02	.02	.00	205.
1.01	10.45	129	.07	.06	.00	627.	1.01	22.45	273	.02	.02	.00	205.
1.01	10.50	130	.07	.06	.00	627.	1.01	22.50	274	.02	.02	.00	205.
1.01	10.55	131	.07	.06	.00	628.	1.01	22.55	275	.02	.02	.00	205.
1.01	11.00	132	.07	.06	.00	628.	1.01	23.00	276	.02	.02	.00	205.
1.01	11.05	133	.07	.06	.00	629.	1.01	23.05	277	.02	.02	.00	205.
1.01	11.10	134	.07	.06	.00	629.	1.01	23.10	278	.02	.02	.00	205.
1.01	11.15	135	.07	.06	.00	630.	1.01	23.15	279	.02	.02	.00	205.
1.01	11.20	136	.07	.06	.00	630.	1.01	23.20	280	.02	.02	.00	205.
1.01	11.25	137	.07	.06	.00	631.	1.01	23.25	281	.02	.02	.00	205.
1.01	11.30	138	.07	.06	.00	631.	1.01	23.30	282	.02	.02	.00	205.
1.01	11.35	139	.07	.06	.00	632.	1.01	23.35	283	.02	.02	.00	205.
1.01	11.40	140	.07	.06	.00	632.	1.01	23.40	284	.02	.02	.00	205.
1.01	11.45	141	.07	.06	.00	632.	1.01	23.45	285	.02	.02	.00	205.
1.01	11.50	142	.07	.06	.00	633.	1.01	23.50	286	.02	.02	.00	205.
1.01	11.55	143	.07	.06	.00	633.	1.01	23.55	287	.02	.02	.00	205.
1.01	12.00	144	.07	.06	.00	633.	1.02	.00	288	.02	.02	.00	205.

SUM 32.24 31.22 1.02 307446.
(819.)(793.)(26.)(8705.90)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8211.	3340.	1067.	1067.	307331.
CMS	232.	95.	30.	30.	8703.
INCHES		24.27	31.02	31.02	31.02
MM		616.58	787.93	787.93	787.93
AC-FT		1656.	2117.	2117.	2117.
THOUS CU M		2043.	2611.	2611.	2611.

HYDROGRAPH AT STA HEAD FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	2.
3.	4.	5.	6.	7.	9.	10.	11.	13.	14.
16.	17.	18.	19.	21.	22.	23.	24.	25.	26.
27.	28.	29.	30.	31.	32.	33.	34.	[illegible]	[illegible]

AC-FT	994.	1270.	1270.	1270.
THOUS CU M	1226.	1566.	1566.	1566.

HYDROGRAPH AT STA HEAD FOR PLAN 1, RTIO 4

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	2.
3.	5.	6.	8.	9.	11.	13.	15.	17.	18.
20.	22.	23.	25.	27.	28.	30.	31.	33.	34.
35.	37.	38.	39.	40.	41.	42.	43.	44.	45.
46.	47.	48.	49.	50.	51.	51.	52.	53.	54.
54.	55.	56.	56.	57.	58.	58.	59.	59.	60.
60.	61.	62.	67.	74.	87.	105.	128.	153.	179.
205.	229.	252.	271.	286.	300.	311.	321.	330.	338.
345.	351.	356.	360.	364.	368.	371.	374.	377.	379.
382.	384.	386.	387.	389.	390.	392.	393.	394.	395.
396.	397.	398.	399.	400.	400.	401.	402.	402.	403.
404.	404.	405.	405.	406.	406.	406.	407.	407.	408.
408.	408.	409.	409.	409.	410.	410.	410.	411.	411.
411.	411.	412.	412.	416.	430.	455.	498.	561.	639.
725.	817.	896.	973.	1041.	1097.	1142.	1181.	1217.	1254.
1292.	1330.	1369.	1405.	1438.	1468.	1494.	1515.	1534.	1553.
1575.	1605.	1639.	1679.	1722.	1765.	1805.	1842.	1874.	1901.
1915.	1929.	1939.	1951.	1984.	2081.	2311.	2688.	3197.	3828.
4467.	4967.	5261.	5337.	5234.	4986.	4640.	4220.	3799.	3444.
3154.	2919.	2727.	2567.	2434.	2325.	2229.	2140.	2056.	1975.
1897.	1833.	1771.	1718.	1672.	1635.	1599.	1556.	1500.	1420.
1313.	1186.	1049.	912.	782.	665.	562.	478.	412.	359.
317.	282.	254.	230.	212.	197.	184.	174.	166.	159.
154.	150.	146.	144.	141.	139.	138.	137.	136.	135.
134.	134.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	133.	133.	133.	133.	133.	133.
133.	133.	133.	133.	133.	133.	133.	133.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5337.	2171.	694.	694.	199765.
CMS	151.	61.	20.	20.	5657.
INCHES		15.78	20.16	20.16	20.16
MM		400.79	512.16	512.16	512.16
AC-FT		1077.	1376.	1376.	1376.
THOUS CU M		1328.	1697.	1697.	1697.

HYDROGRAPH AT STA HEAD FOR PLAN 1, RTIO 5

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	2.	2.
4.	5.	7.	8.	10.	12.	14.	16.	18.	20.
22.	24.	25.	27.	29.	31.	32.	34.	35.	37.
38.	39.	41.	42.	43.	45.	46.	47.	48.	49.
50.	51.	52.	53.	54.	55.	55.	56.	57.	58.
59.	59.	60.	61.	61.	62.	63.	63.	64.	64.
65.	65.	67.	72.	80.	93.	113.	137.	165.	193.
221.	247.	271.	291.	308.	323.	335.	346.	356.	364.

HYDROGRAPH AT STA HEAD FOR PLAN 1, RTIO 8

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	2.	3.
4.	6.	8.	10.	12.	15.	17.	19.	22.	24.
26.	29.	31.	33.	35.	37.	39.	41.	43.	44.
46.	48.	50.	51.	53.	54.	55.	57.	58.	59.
61.	62.	63.	64.	65.	66.	67.	68.	69.	70.
71.	72.	73.	74.	74.	75.	76.	77.	77.	78.
79.	79.	82.	87.	97.	113.	137.	167.	200.	235.
268.	300.	329.	354.	375.	392.	407.	420.	432.	442.
451.	459.	465.	471.	477.	481.	486.	489.	493.	496.
499.	502.	504.	506.	508.	510.	512.	514.	515.	517.
518.	519.	520.	521.	523.	523.	524.	525.	526.	527.
528.	529.	529.	530.	530.	531.	532.	532.	533.	533.
534.	534.	535.	535.	535.	536.	536.	537.	537.	537.
538.	538.	538.	538.	544.	562.	595.	651.	734.	836.
942.	1062.	1172.	1272.	1361.	1434.	1494.	1545.	1592.	1639.
1659.	1740.	1793.	1837.	1881.	1919.	1953.	1981.	2005.	2031.
2063.	2096.	2143.	2196.	2252.	2308.	2361.	2409.	2451.	2485.
2503.	2522.	2534.	2552.	2595.	2721.	3022.	3514.	4161.	5066.
5942.	6436.	6879.	6979.	6844.	6521.	6068.	5519.	4968.	4504.
4124.	3814.	3565.	3357.	3183.	3041.	2915.	2798.	2688.	2583.
2455.	2397.	2316.	2246.	2187.	2137.	2091.	2035.	1961.	1857.
1717.	1551.	1372.	1193.	1022.	869.	735.	624.	538.	470.
415.	369.	332.	301.	277.	257.	241.	228.	217.	209.
202.	196.	191.	188.	185.	182.	180.	179.	177.	176.
175.	175.	174.	174.	174.	174.	174.	174.	174.	174.
174.	174.	174.	174.	174.	174.	174.	174.	174.	174.
174.	174.	174.	174.	174.	174.	174.	174.	174.	174.
174.	174.	174.	174.	174.	174.	174.	174.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6979.	2639.	907.	907.	261232.
CMS	198.	80.	26.	26.	7397.
INCHES		20.63	26.37	26.37	26.37
MM		524.10	669.74	669.74	669.74
AC-FT		1408.	1799.	1799.	1799.
THOUS CU M		1737.	2219.	2219.	2219.

HYDROGRAPH AT STA HEAD FOR PLAN 1, RTIO 9

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	2.	4.
5.	7.	9.	12.	14.	17.	20.	23.	25.	28.
31.	34.	36.	39.	41.	43.	46.	48.	50.	52.
54.	55.	57.	60.	62.	64.	65.	67.	68.	70.
71.	73.	74.	75.	77.	78.	79.	80.	82.	83.
84.	85.	86.	87.	88.	89.	89.	90.	91.	92.
93.	94.	96.	102.	114.	133.	161.	196.	236.	278.
315.	353.	387.	416.	441.	461.	479.	495.	508.	520.
530.	539.	547.	554.	561.	566.	571.	576.	580.	584.
587.	590.	593.	596.	599.	600.	603.	605.	606.	609.
610.	611.	612.	614.	615.	616.	617.	618.	619.	620.
621.	622.	623.	623.	624.	625.	625.	626.	627.	627.

FLOOD HYDROGRAPH PACKAGE - HEC-1   PROGRAM H21/92-1V TIME 19:25:00 CASE 001

628.	629.	629.	629.	630.	630.	631.	631.	632.	632.
632.	633.	633.	633.	640.	661.	700.	766.	863.	963.
1113.	1257.	1379.	1497.	1601.	1688.	1757.	1817.	1873.	1929.
1987.	2047.	2106.	2161.	2213.	2258.	2298.	2330.	2359.	2389.
2427.	2466.	2521.	2583.	2649.	2715.	2777.	2834.	2883.	2924.
2953.	2967.	2989.	3007.	3052.	3201.	3556.	4135.	4919.	5890.
6573.	7443.	8091.	8211.	8092.	7671.	7139.	6493.	5844.	5299.
4852.	4420.	4195.	3949.	3745.	3577.	3429.	3292.	3163.	3039.
2924.	2823.	2725.	2643.	2575.	2515.	2460.	2394.	2308.	2185.
2021.	1825.	1614.	1403.	1203.	1023.	865.	735.	633.	553.
488.	434.	390.	355.	326.	302.	283.	268.	255.	245.
237.	231.	225.	221.	217.	215.	212.	210.	209.	207.
206.	205.	205.	205.	205.	205.	205.	205.	205.	205.
205.	205.	205.	205.	205.	205.	205.	205.	205.	205.
205.	205.	205.	205.	205.	205.	205.	205.	205.	205.
205.	205.	205.	205.	205.	205.	205.	205.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8211.	3340.	1067.	1067.	307331.
CMS	232.	95.	30.	30.	8703.
INCHES		24.27	31.02	31.02	31.02
MM		616.58	787.93	787.93	787.93
AC-FT		1656.	2117.	2117.	2117.
THOUS CU M		2043.	2611.	2611.	2611.

HYDROGRAPH ROUTING

ROUTE HYDROGRAPHS PAST DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
.0	.000	.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	.000	.000	.000	-983.	-1

STAGE	983.30	983.80	984.00	984.50	985.00	985.50	986.00	987.00	988.00	988.30
	989.00	990.00	991.00	992.00	995.00					
FLOW	.00	17.00	27.00	51.00	65.00	76.00	85.00	99.00	128.00	140.00
	171.00	195.00	197.00	200.00	207.00					

SURFACE AREA=	0.	1.	7.	26.	69.	117.	204.	321.
CAPACITY=	0.	0.	32.	190.	612.	1484.	3074.	5679.
ELEVATION=	933.	940.	950.	960.	970.	980.	990.	1000.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
983.3	.0	.0	.0	.0	.0	.0	.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
988.3	.0	.0	0.

CREST LENGTH AT OR BELOW	0.	65.	230.	380.	465.	1045.	1203.	2195.	2435.
ELEVATION	985.2	985.9	987.0	988.0	988.3	988.8	989.0	989.7	990.0

STATION DAM, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	3.	3.	3.	3.	3.	3.	3.
4.	4.	4.	4.	5.	5.	5.	6.	6.	7.
7.	8.	8.	9.	9.	9.	10.	10.	11.	11.
11.	12.	12.	13.	13.	14.	14.	15.	15.	16.
16.	16.	17.	18.	18.	19.	20.	20.	21.	22.
22.	23.	24.	24.	25.	26.	26.	27.	28.	28.
29.	29.	30.	31.	31.	32.	33.	33.	34.	34.
35.	36.	36.	37.	38.	38.	39.	40.	40.	41.
43.	43.	45.	46.	48.	49.	51.	52.	53.	54.
56.	57.	58.	59.	60.	62.	63.	64.	66.	67.
69.	69.	70.	71.	73.	75.	78.	81.	85.	90.
95.	102.	109.	117.	127.	138.	152.	170.	195.	230.
277.	344.	426.	524.	631.	746.	862.	972.	1079.	1153.
1223.	[illegible]	1327.	1365.	1396.	1420.	1438.	1452.	1461.	1466.
1467.	1465.	1461.	1454.	1446.	1436.	1426.	1414.	1401.	1385.
1367.	1345.	1319.	1289.	1256.	1220.	1182.	1143.	1104.	1066.
1025.	991.	956.	922.	889.	859.	830.	802.	776.	752.
729.	707.	686.	666.	648.	630.	613.	597.	582.	567.
554.	540.	528.	516.	504.	493.	482.	472.	462.	453.
444.	435.	427.	419.	411.	404.	397.	390.	383.	377.
371.	365.	359.	354.	348.	343.	338.	333.	328.	324.
319.	315.	311.	307.	303.	299.	295.	292.		

STORAGE

1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.
1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.
1914.	1914.	1914.	1915.	1915.	1915.	1915.	1915.	1915.	1915.
1915.	1915.	1915.	1915.	1915.	1916.	1916.	1916.	1916.	1916.
1916.	1917.	1917.	1917.	1917.	1917.	1918.	1918.	1918.	1918.
1919.	1919.	1919.	1919.	1920.	1920.	1920.	1920.	1921.	1921.
1921.	1921.	1922.	1922.	1922.	1923.	1923.	1923.	1923.	1924.
1924.	1924.	1925.	1925.	1925.	1926.	1926.	1927.	1928.	1928.
[illegible]	[illegible]	1932.	1933.	1935.	1936.	1938.	[illegible]	[illegible]	[illegible]

AC-FT	651.	756.	768.	768.
THOUS CU M	802.	946.	948.	948.

STATION DAM, PLAN 1, RATIO 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	3.	4.	4.	4.	4.
5.	5.	5.	6.	6.	7.	7.	8.	8.	9.
9.	10.	10.	11.	11.	12.	13.	13.	14.	14.
15.	15.	16.	17.	17.	18.	19.	20.	21.	22.
23.	23.	24.	25.	26.	27.	28.	28.	29.	30.
31.	32.	33.	33.	34.	35.	36.	37.	37.	38.
39.	40.	41.	41.	42.	43.	44.	45.	45.	46.
47.	48.	49.	49.	50.	51.	51.	52.	53.	53.
54.	55.	56.	57.	58.	59.	61.	62.	64.	65.
66.	67.	69.	70.	71.	73.	75.	79.	82.	87.
92.	99.	107.	116.	126.	139.	154.	171.	191.	214.
239.	257.	297.	329.	363.	401.	446.	500.	571.	665.
791.	955.	1151.	1366.	1588.	1802.	1998.	2164.	2297.	2395.
2465.	2539.	2534.	2543.	2539.	2527.	2507.	2482.	2452.	2419.
2392.	2344.	2304.	2263.	2222.	2182.	2142.	2103.	2063.	2023.
1979.	1931.	1878.	1821.	1759.	1696.	1630.	1565.	1500.	1437.
1376.	1318.	1263.	1211.	1161.	1114.	1070.	1028.	989.	951.
916.	884.	853.	824.	797.	772.	748.	726.	705.	685.
664.	648.	631.	615.	600.	586.	572.	559.	546.	534.
522.	511.	501.	491.	481.	472.	463.	454.	446.	438.
435.	423.	416.	409.	402.	396.	390.	384.	378.	373.
369.	362.	357.	353.	349.	343.	339.	335.		

STORAGE

1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.
1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.
1914.	1914.	1914.	1915.	1915.	1915.	1915.	1915.	1915.	1915.
1915.	1915.	1915.	1916.	1916.	1916.	1916.	1916.	1917.	1917.
1917.	1917.	1918.	1918.	1918.	1918.	1919.	1919.	1919.	1920.
1920.	1920.	1920.	1921.	1921.	1921.	1922.	1922.	1922.	1923.
1923.	1924.	1924.	1924.	1925.	1925.	1925.	1926.	1926.	1927.
1927.	1927.	1928.	1928.	1929.	1929.	1930.	1931.	1932.	1933.
1934.	1935.	1937.	1939.	1941.	1943.	1945.	1947.	1949.	1951.
1954.	1956.	1958.	1961.	1963.	1966.	1968.	1970.	1973.	1975.
1977.	1980.	1983.	1986.	1988.	1991.	1993.	1996.	1998.	2001.
2004.	2006.	2009.	2011.	2014.	2016.	2019.	2022.	2024.	2027.
2029.	2032.	2034.	2037.	2039.	2042.	2045.	2047.	2050.	2052.
2055.	2057.	2060.	2062.	2065.	2067.	2070.	2072.	2075.	2078.
[illegible]	[illegible]	2085.	[illegible]	2090.	2093.	2095.	2098.	[illegible]	[illegible]

2113.	2115.	2120.	2126.	2133.	2140.	2147.	2154.	2162.	2170.
2179.	2187.	2196.	2205.	2214.	2224.	2234.	2243.	2253.	2263.
2274.	2284.	2294.	2305.	2316.	2327.	2338.	2350.	2361.	2373.
2384.	2395.	2407.	2418.	2430.	2441.	2453.	2467.	2484.	2504.
2527.	2554.	2582.	2610.	2636.	2659.	2679.	2696.	2708.	2717.
2723.	2727.	2728.	2729.	2729.	2728.	2726.	2724.	2721.	2719.
2715.	2712.	2708.	2705.	2701.	2697.	2693.	2690.	2686.	2682.
2677.	2672.	2667.	2661.	2655.	2648.	2641.	2633.	2626.	2618.
2611.	2604.	2597.	2590.	2583.	2577.	2570.	2564.	2559.	2553.
2549.	2543.	2538.	2533.	2528.	2524.	2520.	2515.	2511.	2508.
2504.	2500.	2497.	2493.	2490.	2487.	2484.	2481.	2478.	2475.
2473.	2470.	2467.	2465.	2462.	2460.	2458.	2455.	2453.	2451.
2449.	2447.	2445.	2443.	2441.	2439.	2438.	2436.	2434.	2433.
2431.	2429.	2428.	2426.	2425.	2423.	2422.	2420.		

STAGE

983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.4	983.4	983.4	983.4
983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4
983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4
983.4	983.4	983.5	983.5	983.5	983.5	983.5	983.5	983.5	983.6
983.6	983.6	983.6	983.6	983.6	983.7	983.7	983.7	983.7	983.7
983.7	983.8	983.8	983.8	983.8	983.8	983.8	983.9	983.9	983.9
983.9	983.9	983.9	984.0	984.0	984.0	984.0	984.0	984.0	984.1
984.1	984.1	984.1	984.1	984.2	984.2	984.2	984.2	984.2	984.2
984.3	984.3	984.3	984.3	984.3	984.3	984.4	984.4	984.4	984.4
984.4	984.4	984.5	984.5	984.5	984.5	984.5	984.5	984.6	984.6
984.6	984.6	984.7	984.7	984.8	984.8	984.8	984.9	984.9	985.0
985.1	985.1	985.2	985.2	985.3	985.3	985.4	985.5	985.5	985.6
985.6	985.7	985.8	985.8	985.9	986.0	986.0	986.1	986.2	986.2
986.3	986.4	986.4	986.5	986.6	986.6	986.7	986.8	986.9	987.0
987.1	987.3	987.4	987.6	987.7	987.9	988.0	988.1	988.1	988.2
988.2	988.2	988.2	988.2	988.2	988.2	988.2	988.2	988.2	988.2
988.2	988.1	988.1	988.1	988.1	988.1	988.0	988.0	988.0	988.0
988.0	987.9	987.9	987.9	987.8	987.8	987.8	987.7	987.7	987.6
987.6	987.6	987.5	987.5	987.4	987.4	987.4	987.3	987.3	987.3
987.2	987.2	987.2	987.2	987.1	987.1	987.1	987.1	987.0	987.0
987.0	987.0	987.0	986.9	986.9	986.9	986.9	986.9	986.8	986.8
986.8	986.8	986.8	986.8	986.8	986.7	986.7	986.7	986.7	986.7
986.7	986.7	986.7	986.6	986.6	986.6	986.6	986.6	986.6	986.6
986.6	986.6	986.6	986.6	986.5	986.5	986.5	986.5		

PEAK OUTFLOW IS 2543. AT TIME 17.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2543.	1490.	436.	478.	126279.
CMS	72.	42.	12.	12.	3576.
INCHES		10.83	12.75	12.75	12.75
MM		275.02	323.75	323.75	323.75
AC-FT		739.	870.	870.	870.
THOUS CU M		911.	1073.	1073.	1073.

FLOOD HYDROGRAPH PACKAGE - HEC-1 PROGRAM H21/C2-1V TIME 18:25:00 CASE 801

2649.	2640.	2632.	2624.	2616.	2608.	2601.	2593.	2587.	2580.
2574.	2568.	2562.	2557.	2551.	2546.	2541.	2537.	2532.	2528.
2524.	2520.	2516.	2512.	2508.	2505.	2501.	2498.	2495.	2492.
2489.	2486.	2483.	2481.	2479.	2476.	2473.	2471.	2468.	2466.
2464.	2462.	2460.	2458.	2456.	2454.	2452.	2450.	2448.	2447.
2445.	2443.	2442.	2440.	2439.	2437.	2436.	2434.		

STAGE

983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4
983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4
983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.5	983.5
983.5	983.5	983.5	983.5	983.5	983.6	983.6	983.6	983.6	983.6
983.7	983.7	983.7	983.7	983.7	983.8	983.8	983.8	983.8	983.8
983.9	983.9	983.9	983.9	984.0	984.0	984.0	984.0	984.0	984.1
984.1	984.1	984.1	984.2	984.2	984.2	984.2	984.2	984.3	984.3
984.3	984.3	984.4	984.4	984.4	984.4	984.4	984.5	984.5	984.5
984.5	984.6	984.6	984.6	984.6	984.6	984.7	984.7	984.7	984.7
984.7	984.8	984.8	984.8	984.8	984.9	984.9	984.9	984.9	985.0
985.0	985.0	985.1	985.1	985.2	985.2	985.3	985.4	985.4	985.5
985.6	985.6	985.7	985.8	985.8	985.9	986.0	986.1	986.1	986.2
986.3	986.4	986.4	986.5	986.6	986.7	986.7	986.8	986.9	987.0
987.0	987.1	987.2	987.2	987.3	987.4	987.4	987.5	987.6	987.7
987.9	988.0	988.2	988.3	988.5	988.6	988.7	988.8	988.8	988.8
988.8	988.8	988.8	988.8	988.7	988.7	988.7	988.6	988.6	988.6
988.5	988.5	988.5	988.5	988.4	988.4	988.4	988.3	988.3	988.3
988.3	988.2	988.2	988.1	988.1	988.1	988.0	988.0	987.9	987.9
987.8	987.8	987.7	987.7	987.6	987.6	987.5	987.5	987.5	987.4
987.4	987.4	987.3	987.3	987.3	987.2	987.2	987.2	987.2	987.1
987.1	987.1	987.1	987.0	987.0	987.0	987.0	987.0	986.9	986.9
986.9	986.9	986.9	986.9	986.9	986.8	986.8	986.8	986.8	986.8
986.8	986.8	986.7	986.7	986.7	986.7	986.7	986.7	986.7	986.7
986.7	986.7	986.6	986.6	986.6	986.6	986.6	986.6		

PEAK OUTFLOW IS 4315. AT TIME 16.67 HOURS

	PEAK	2-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4315.	2205.	645.	645.	185721.
CMS	122.	62.	18.	18.	5259.
INCHES		16.02	18.75	18.75	18.75
MM		406.97	476.15	476.15	476.15
AC-FT		1093.	1279.	1279.	1279.
THOUS CU M		1348.	1578.	1578.	1578.

STATION DAM, PLAN 1, RATIO 9

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	2.	2.	2.	2.
2.	2.	2.	2.	2.	3.	3.	3.	3.	3.
3.	3.	3.	4.	4.	4.	4.	4.	4.	4.
5.	5.	5.	5.	5.	5.	6.	6.	6.	7.
7.	8.	8.	9.	10.	10.	11.	12.	12.	13.
14.	15.	16.	17.	18.	19.	20.	22.	23.	24.
25.	27.	28.	29.	30.	32.	33.	34.	35.	37.
39.	39.	40.	42.	43.	44.	45.	47.	48.	49.
50.	51.	52.	53.	53.	54.	55.	56.	56.	57.
58.	58.	59.	60.	61.	61.	62.	63.	63.	64.
65.	65.	64.	66.	67.	68.	68.	69.	69.	70.
71.	73.	75.	78.	81.	86.	92.	99.	108.	119.
133.	148.	168.	191.	218.	249.	283.	322.	365.	411.
461.	515.	573.	635.	702.	773.	853.	936.	1023.	1117.
1203.	1297.	1384.	1473.	1562.	1655.	1761.	1893.	2068.	2364.
2419.	3215.	3509.	4064.	4628.	5135.	5517.	5747.	5823.	5777.
5632.	5443.	5287.	5087.	4889.	4699.	4521.	4356.	4232.	4058.
3921.	3797.	3673.	3560.	3455.	3358.	3268.	3184.	3107.	3022.
2932.	2849.	2752.	2649.	2541.	2430.	2318.	2208.	2101.	1999.
1932.	1809.	1722.	1740.	1563.	1491.	1424.	1361.	1302.	1247.
1134.	1140.	1107.	1061.	1021.	984.	950.	917.	887.	859.
832.	807.	784.	762.	741.	722.	703.	686.	669.	653.
639.	625.	611.	598.	586.	574.	563.	553.	542.	533.
523.	514.	505.	497.	489.	481.	474.	467.	460.	453.
447.	441.	435.	429.	423.	418.	413.	408.		

STORAGE

1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.
1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.	1914.
1914.	1914.	1915.	1915.	1915.	1915.	1915.	1915.	1915.	1915.
1916.	1916.	1916.	1916.	1917.	1917.	1917.	1918.	1918.	1918.
1919.	1919.	1919.	1920.	1920.	1921.	1921.	1921.	1922.	1922.
1923.	1923.	1924.	1924.	1925.	1925.	1926.	1926.	1927.	1927.
1928.	1929.	1929.	1930.	1930.	1931.	1931.	1932.	1933.	1933.
1934.	1934.	1935.	1936.	1936.	1937.	1938.	1939.	1941.	1943.
1945.	1947.	1949.	1952.	1955.	1958.	1961.	1964.	1968.	1971.
1975.	1978.	1982.	1986.	1989.	1993.	1997.	2001.	2004.	2008.
2012.	2016.	2020.	2024.	2028.	2032.	2036.	2040.	2043.	2047.
2051.	2055.	2059.	2063.	2067.	2071.	2075.	2079.	2083.	2087.
2091.	2095.	2099.	2102.	2106.	2110.	2114.	2118.	2122.	2126.
2131.	2134.	2138.	2142.	2146.	2150.	2153.	2157.	2161.	2165.
2169.	2173.	2177.	2181.	2185.	2189.	2193.	2198.	2203.	2209.
2215.	2223.	2231.	2241.	2251.	2262.	2273.	2285.	2297.	2309.
2322.	2334.	2348.	2361.	2375.	2389.	2402.	2416.	2430.	2444.
2457.	2471.	2484.	2498.	2511.	2524.	2538.	2551.	2564.	2576.
2589.	2600.	2612.	2622.	2633.	2643.	2655.	2669.	2686.	2708.
2735.	2766.	2799.	2828.	2854.	2874.	2889.	2897.	2899.	2898.
[illegible]	2887.	2880.	2872.	2865.	2857.	2849.	2842.	2835.	2827.
2820.	2814.	2807.	2801.	2794.	2789.	2783.	2777.	2772.	2766.
2760.	2754.	2746.	2738.	2729.	2720.	2710.	2700.	2689.	2679.
2670.	2660.	2651.	2642.	2633.	2625.	2617.	2609.	2602.	2594.
[illegible]	[illegible]	2577.	2569.	2564.	2558.	2553.	2548.	2543.	2539.

FLOOD HYDROGRAPH PACKAGE - HEC-1 PROGRAM H21/02-1V TIME 18:25:00 CASE 001

2534.	2530.	2526.	2522.	2518.	2515.	2511.	2508.	2505.	2501.
2498.	2495.	2493.	2490.	2487.	2485.	2482.	2480.	2477.	2475.
2473.	2471.	2468.	2466.	2464.	2462.	2461.	2459.	2457.	2455.
2454.	2452.	2450.	2449.	2447.	2446.	2444.	2443.		

STAGE

983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3
983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.3	983.4	983.4
983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4
983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4	983.4
983.4	983.4	983.4	983.4	983.5	983.5	983.5	983.5	983.5	983.5
983.5	983.5	983.5	983.6	983.6	983.6	983.6	983.6	983.7	983.7
983.7	983.7	983.8	983.8	983.8	983.8	983.9	983.9	983.9	983.9
984.0	984.0	984.0	984.0	984.1	984.1	984.1	984.2	984.2	984.2
984.2	984.3	984.3	984.3	984.3	984.4	984.4	984.4	984.4	984.5
984.5	984.5	984.5	984.6	984.6	984.6	984.6	984.7	984.7	984.7
984.7	984.8	984.8	984.8	984.8	984.9	984.9	984.9	984.9	985.0
985.0	985.0	985.0	985.1	985.1	985.1	985.1	985.2	985.2	985.2
985.3	985.3	985.4	985.4	985.5	985.6	985.6	985.7	985.8	985.9
985.9	986.0	986.1	986.2	986.2	986.3	986.4	986.5	986.6	986.7
986.7	986.8	986.9	987.0	987.0	987.1	987.2	987.3	987.3	987.4
987.5	987.5	987.6	987.7	987.7	987.8	987.8	987.9	988.0	988.1
988.3	988.4	988.6	988.8	988.9	989.0	989.1	989.1	989.1	989.1
989.1	989.1	989.0	989.0	988.9	988.9	988.9	988.8	988.8	988.8
988.7	988.7	988.6	988.6	988.6	988.6	988.5	988.5	988.5	988.4
988.4	988.4	988.3	988.3	988.2	988.2	988.1	988.1	988.0	988.0
987.9	987.9	987.8	987.8	987.7	987.7	987.6	987.6	987.5	987.5
987.5	987.4	987.4	987.4	987.3	987.3	987.3	987.2	987.2	987.2
987.2	987.1	987.1	987.1	987.1	987.1	987.0	987.0	987.0	987.0
987.0	986.9	986.9	986.9	986.9	986.9	986.9	986.9	986.8	986.8
986.8	986.8	986.8	986.8	986.8	986.8	986.7	986.7	986.7	986.7
986.7	986.7	986.7	986.7	986.7	986.7	986.7	986.6		

PEAK OUTFLOW IS 5823. AT TIME 16.58 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5823.	2744.	801.	801.	230581.
CMS	165.	78.	23.	23.	6529.
INCHES		19.94	23.27	23.27	23.27
MM		506.53	591.16	591.16	591.16
AC-FT		1361.	1588.	1588.	1588.
THOUS CU M		1678.	1959.	1959.	1959.

FLOOD HYDROGRAPH PACKAGE - HEC-1 PROGRAM H21/02-1V TIME 18:25:00 CASE 801

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

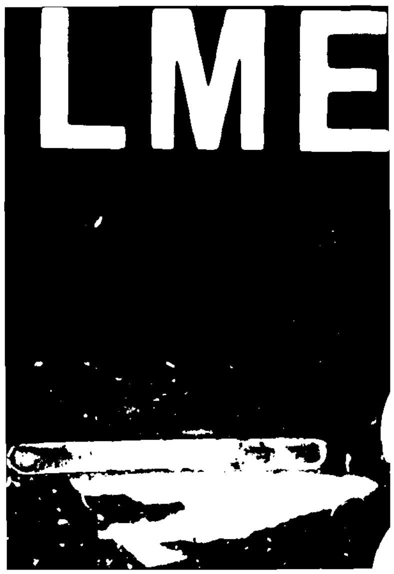
				RATIOS APPLIED TO FLOWS								
OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				.50	.55	.60	.65	.70	.75	.80	.85	1.00
HYDROGRAPH AT	HEAD	1.29	1	4105.	4516.	4926.	5337.	5747.	6158.	6568.	6979.	8211.
	(	3.32)	(	116.25)(	127.87)(	139.50)(	151.12)(	162.75)(	174.37)(	186.00)(	197.62)(	232.50)
ROUTED TO	DAM	1.28	1	1467.	1803.	2161.	2543.	2946.	3380.	3841.	4315.	5823.
	(	3.32)	(	41.55)(	51.07)(	61.20)(	72.00)(	83.44)(	95.72)(	108.76)(	122.19)(	164.88)

FLOOD HYDROGRAPH PACKAGE - HEC-1 PROGRAM H21/02-1V TIN. 18:25:00 CASE 801

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	983.30	983.30	988.30
	STORAGE	1914.	1914.	2741.
	OUTFLOW	0.	0.	2686.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	987.66	.00	2622.	1467.	.00	17.58	.00
.55	987.88	.00	2659.	1803.	.00	17.33	.00
.60	988.[illegible]6	.00	2695.	2161.	.00	17.17	.00
.65	988.[illegible]4	.00	2725.	2543.	.00	17.00	.00
.70	988.41	.11	2761.	2946.	1.00	16.92	.00
.75	988.56	.26	2790.	3783.	1.50	16.83	.00
.80	988.70	.40	2816.	3941.	1.92	16.75	.00
.85	988.82	.52	2840.	4315.	2.17	16.67	.00
1.00	989.13	.83	2899.	5823.	2.67	16.58	.00


LME